DRAFT FINAL

TECHNICAL MEMORANDUM NO. 1

ADDENDUM TO PHASE I RFI/RI WORK PLAN
FIELD SAMPLING PLAN
VOLUME I, PART A - OUTSIDE TANKS

OPERABLE UNIT NO. 9 - ORIGINAL PROCESS WASTE LINES

U.S. Department of Energy
Rocky Flats Plant
Golden, Colorado

March 2, 1994

Approved By:

	Director	*(Date)*
	Project Manager	*(Date)*
TITLE: Operable Unit 9 Technical Memorandum No.1 Volume I, Part A	*Quality Assurance Program Manager*	*(Date)*

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LIST OF ABBREVIATIONS AND ACRONYMS

CCl_4	Carbon Tetrachloride
CDH	State of Colorado Department of Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHWA	Colorado Hazardous Waste Act
CLP	Contract Laboratory Program
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
EMD	Environmental Management Department
EPA	U.S. Environmental Protection Agency
FO	Field Operations
GPS	Global Positioning System
GT	Geotechnical
HPGe	High Purity Germanium
HRR	Historical Release Report
IA	Industrial Area
IAG	Inter-Agency Agreement
IHSS	Individual Hazardous Substance Site
l	liter
ml	milliliter
NaI	Sodium Iodide
OP	Operating Procedure
OPWL	Original Process Waste Lines
OU	Operable Unit
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCBs	Polychlorinated Biphenyls
QA	Quality Assurance
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RF	Rocky Flats
RFI/RI	RCRA Facility Investigation/Remedial Investigation
RFP	Rocky Flats Plant

LIST OF ABBREVIATIONS AND ACRONYMS
(continued)

SVOL	semivolatile
SW	Surface Waste
Ta	Tantalum
TAL	Target Analyte List
TCL	Target Compound List
TOC	Total Organic Carbon
WCPL	Water Quality Parameter List

Approved By:

	Director	*(Date)*
	Project Manager	*(Date)*
TITLE: Operable Unit 9 Technical Memorandum No.1 Volume I, Part A	*Quality Assurance Program Manager*	*(Date)*

1.0 INTRODUCTION

This document is submitted in partial fulfillment of the Phase I Resource Conservation and Recovery Act (RCRA) Facility Investigation/Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation (RFI/RI) Work Plan requirements and presents the first part (Volume I, Part A) of the Field Sampling Plan for Operable Unit (OU) 9. Volume I, Part A presents the Field Sampling Plan for tanks located in areas outside of the large buildings; Volume I, Part B of Technical Memorandum No. 1 will present the Field Sampling Plan for tanks located inside large buildings; and Volume II of Technical Memorandum No. 1 will present the sampling plan for pipelines. Part B of Volume I and Volume II will be submitted at a later date as an addendum to Technical Memorandum No. 1.

This work is part of a comprehensive, multi-staged program of site characterization, RIs, feasibility studies, and remedial/corrective actions currently in progress at the U.S. Department of Energy (DOE) Rocky Flats Plant (RFP). These activities are pursuant to an Inter-Agency Agreement (IAG) among DOE, the U.S. Environmental Protection Agency (EPA), and the State of Colorado Department of Health (CDH), dated January 22, 1991 (DOE 1991). The IAG program developed by DOE, EPA, and CDH, addresses RCRA and CERCLA, and Colorado Hazardous Waste Act (CHWA) issues. Further information on the investigation at OU9 is found in the *Phase I RFI/RI Work Plan OU9* (DOE 1992a).

1.1 BACKGROUND

OU9 is the Original Process Waste Lines (OPWL). The OPWL comprises 39 tank locations (included are an assortment of above-, on-, and below-grade tanks; floor sumps; valve vaults; secondary containment structures; and process waste pits) and approximately 35,000 feet of pipeline. Ten of the 39 tank designations have duplicate IHSS numbers. Tank and duplicate IHSS numbers are listed in Table 1-1. Tank, pipeline, and duplicate IHSS locations are shown in Figure 1-1.

The general function of the OPWL was to transfer and store process waste from facilities that generated the wastes to the process waste treatment facility that was housed in Building 774. The OPWL transported (or stored in OPWL tanks) various aqueous process wastes containing low-level radioactive materials, nitrates, caustics, and acids. Small quantities of other liquids were also handled in the system, including pickling liquor from foundry operations, medical decontamination fluids, miscellaneous laboratory wastes, and laundry effluent. Certain process waste streams also contained metals, volatile organic compounds, oil and grease, and cleaning compounds (DOE 1992a).

1.2 PURPOSE AND SCOPE

Sampling activities for OU9 will be addressed in two separate parts: Volume I - Tanks, and Volume II - Pipelines. Volume I, the tank investigations, will be addressed first because they pose a greater risk from a potentially larger volume of contaminants. Volume I has been divided into two areas: Part A addresses tanks located outside of the buildings, and Part B will address tanks located inside of the buildings. The subject of this Technical Memorandum is Volume I, Part A - Outside Tanks. Part B (Inside Tanks) and Volume II (Pipelines) are planned to be submitted at a later date.

TABLE 1-1
TANK DESCRIPTIONS
OU9 ORIGINAL PROCESS WASTE LINES

TANK NUMBER	IHSS	BUILDING NO.(1)	NUMBER OF TANKS	CONSTRUCTION TYPE(2)	VOLUME (gal)	CONSTRUCTION MATERIAL(3)	TANK STATUS(4)	YEAR INSTALLED
T-1	NA	122	1	UG	800	SS	Removed (Jan 1984)	1955
T-2	122	441	1	UG	3,000	Conc	Abandoned (June 1982)	1952
T-3	122	441 (429)	2	1 - UG, 1 - AG1	UG-3,000, AG-3,200	UG-Conc, AG-Stl	Abandoned (June 1982)	1952
T-4	NA	447	3	FS	60 ea	Conc	Active(a)	1962
T-5	NA	444	2	AG1	4,000 ea	Stl	Active(b)	1952
T-6	NA	444	2	FS	500 & 300	Conc	Active(a)	1952
T-7	159	559 (528)	2	AG2	2,000 ea	Stl	Currently inactive (90-day)*	1969
T-8	126	771 (728)	2	UG	25,000 ea	Conc	Plenum deluge(d)	1952
T-9	132	776 (730)	2	UG	22,500 ea	Conc	Plenum deluge(d)	1955
T-10	132	776 (730)	2	UG	4,500 ea	Conc	Abandoned (Dec 1982)	1955
T-11	NA	707 (731)	2	UG	2,000 ea	Conc	Active(e)	1959
T-12	NA	N/A	N/A	N/A	N/A	N/A	Invalid tank location	N/A
T-13	215	774	1	SU	600	Conc	Abandoned (1972)	1952
T-14	124	774	1	UG	30,000	Conc	Abandoned (1989)	1952
T-15	146	774	2	UG	7,500 ea	Conc	Removed (1972)	1969
T-16	124,125	774	2	UG	14,000 ea	Conc	Abandoned (1989)	1952
T-17	146	774	4	UG	2-3,750; 2-7,500	Conc	Removed (1972)	1969
T-18	NA	778	1	SU	Unknown	Conc	Abandoned (1982?)	Unk.
T-19	NA	779	2	SU	1,000 ea	Conc	Plenum deluge(d)	1964
T-20	NA	779	2	SU	8,000 ea	Conc	Abandoned (Dec 1982)	1964
T-21	NA	886 (828)	1	FS	250	Conc	Abandoned (1978)	1963
T-22	NA	886 (828)	2	AG2	250 ea	SS	Abandoned (1978)	1963
T-23	NA	865	1	SU	6,000	Conc	Abandoned (May 1982)	1979
T-24	NA	881 (887)	7	AG2	2,700 ea	Stl	Active(b)	1952
T-25	NA	883	2	AG1	750 ea	Stl	Active(b)	1952
T-26	NA	883	3	AG1	750 ea	Stl	Active(b)	1965
T-27	NA	886	1	AG1	500	Stl	Removed (July 1989)	Unk.
T-28	NA	889	2	FS	1,000	Conc	Active(a)	1965

TABLE 1-1 (continued)
TANK DESCRIPTIONS
OU9 ORIGINAL PROCESS WASTE LINES

TANK NUMBER	IHSS	BUILDING NO.(1)	NUMBER OF TANKS	CONSTRUCTION TYPE(2)	VOLUME (gal)	CONSTRUCTION MATERIAL(3)	TANK STATUS(4)	YEAR INSTALLED
T-29	NA	774	1	OG	200,000	Stl	Abandoned (1985)	1952
T-30	NA	707 (731)	1	SU	23,111	Conc	Active(e)	1959
T-31	NA	N/A	N/A	N/A	N/A	N/A	Invalid tank location	N/A
T-32	NA	881 (887)	1	SU	131,160	Conc	Active(e)	1952
T-33	NA	N/A	N/A	N/A	N/A	N/A	Invalid tank location	N/A
T-34	NA	N/A	N/A	N/A	N/A	N/A	Invalid tank location	N/A
T-35	NA	N/A	N/A	N/A	N/A	N/A	Invalid tank location	N/A
T-36	NA	771C	1	SU	500	Stl	Abandoned (1984)	1965
T-37	NA	771C	1	SU	500	Conc	Abandoned (1984?)	Unk.
T-38	NA	779	1	AG2	1,000	Stl	Active(c)	Unk.
T-39	NA	881	4	AG1	250 ea	Stl	Removed (1975)	1952

Notes:

(1) Building numbers in parentheses are process waste pits adjacent to production buildings.

(2) Tank Types:

FS	Floor Sump (used for spill control)
SU	Sump (open-top or covered)
UG	Underground (sealed, permanently closed top)
AG1	Above-Grade
AG2	Above-Grade in sump
OG	On-Grade

(3) Tank Materials:

SS	Stainless Steel
Stl	Steel
Conc	Concrete

(4) Active Tank Categories (as marked):

a	Incidental spill control; not RCRA-permitted
b	RCRA-interim status process waste tank
c	90-day transuranic waste tank
d	Converted to the RFP plenum fire deluge system as a firewater catch tank
e	Secondary containment for RCRA-permitted waste tank

N/A = Not Applicable
NO = Number
RCRA = Resource Conservation and Recovery Act
RFP = Rocky Flats Plant
*Currently inactive and undergoing 90-day closure for subsequent reuse

The outside tanks in the OPWL are generally tanks in open areas of the Industrial Area (IA) at RFP and are either outside or are within small buildings that only enclose the tank. There are 19 outside tank locations. The tank numbers and descriptions for outside tanks are listed in Table 1-2. Potential overlap of these tanks with other OUs or Individual Hazardous Substance Sites (IHSSs) is shown in Table 1-3.

The tank investigations comprise two stages. Stage 1 is designed to locate areas of contamination within the OU9 vadose zone soils and to assess the nature of contamination at these locations. Technical Memorandum No. 1 is for Stage 1 sampling activities that consist of the following:

- visual inspections of tanks;
- residue and wipe samples;
- surface soil samples;
- soil boreholes and soil samples;
- water samples from valve vaults;
- groundwater samples from soil boreholes; and
- radiological measurements.

As part of Stage 1 activities, soil and groundwater samples will be collected from boreholes located as closely as possible to the tanks to verify if leaks have occurred. Residue or wipe samples will be collected from inactive tanks that have not been decontaminated (i.e., cleaned and painted). These samples will be used to evaluate the tanks' historical contents and will help determine potential closure activities such as removal, decontamination, filling with inert material and capping, or future decontamination and decommissioning (D&D).

OPWL structural features, historical release reports, and field observations will be used to identify primary sampling locations. Analytical results from these sampling activities will

TABLE 1-2
OUTSIDE TANK/INDIVIDUAL HAZARDOUS SUBSTANCE SITE NUMBERS AND DESCRIPTIONS
OU9 ORIGINAL PROCESS WASTE LINES

TANK NUMBER	OTHER IHSS NOS.	EG&G TANK NUMBER	BUILDING NO.	NUMBER OF TANKS	CONSTRUCTION TYPE	VOLUME	CONSTRUCTION MATERIAL	WASTE STREAM	TANK STATUS	DATE	AIR EMISSION INVENTORY NO.	RCRA ID NUMBER
T-1	NA	UNKNOWN	122	1	UG	800	STAINLESS	BLDG 122 WASTE	REMOVED	JAN 1984	-	-
T-2	122	UNKNOWN	441	1	UG	3,000	CONCRETE	BLDG 122, 123, 441 WASTE	PART REMOVED	1968	-	-
T-3	122	T-123	441	1	AG	3,200	STEEL	BLDG 122, 123, 441 WASTE	ABANDONED	JUNE 1982	#00076	-
				1	UG	3,000	CONCRETE	BLDG 122, 123, 441 WASTE	ABANDONED	JUNE 1982	#00077	-
T-7	159	T1-522, T2-523	559(528)	2	AG in sump	2,000	STEEL	BLDG 559 WASTE	INACTIVE (90 DAY)*		-	?
T-8	126	T8 EAST, T8 WEST	771(726)	2	UG	25,000	CONCRETE	771 WASTE AND 771 PLENUM DELUGE	CONVERTED TO PLENUM DELUGE	MAY 1984	T1-#00292, T2-#00293	- -
T-9	132	730 TANKS	776(730)	2	UG	22,500	CONCRETE	LAUNDRY WATER FROM BLDG 776	CONVERTED TO PLENUM DELUGE	OCT 1984		-
T-10	132	730 TANKS	776(730)	2	UG	4,500	CONCRETE	LAUNDRY WATER FROM BLDG 776	ABANDONED	DEC 1982		-
T-11	NA	EAST & WEST PROCESS WASTE TANKS	707(731)	2	UG	2,000	CONCRETE	BLDG 707	ACTIVE, INCIDENTAL SPILL CONTROL		-	CONTAMINANT REF #2011
T-30	NA	731 STRUCTURE	731	1	SUMP	23,111	CONCRETE	BLDG 707	ACTIVE, INCIDENTAL SPILL CONTROL		-	CONTAMINANT REF #2011
T-14	124	T-66	774	1	UG	30,000	CONCRETE	BLDG 774 HIGH-NITRATE WASTE	ABANDONED	NOV 1989	#184, NDT-1167	#55.16
T-16	124, 125	T-66, T-67	774	2	UG	14,000	CONCRETE	BLDG 774 HIGH-NITRATE WASTE	ABANDONED	NOV 1989	NDT-T66-1165, NDT-T67-1166	T66-#55.14, T67-#55.15
T-15	146	T-34E, T34W	774	2	UG	7,500	CONCRETE	BLDG 774 TREATED AQUEOUS WASTE	REMOVED	1972	-	-
T-17	146	T-30, T-33	774	2	UG	3,750	CONCRETE	BLDG 774 TREATED AQUEOUS WASTE	REMOVED	1972	-	-
		T-31, T-32		2	UG	7,500	CONCRETE	BLDG 774 TREATED AQUEOUS WASTE	REMOVED	1972	-	-
T-21	NA	BLDG 881 FLOOR SUMP	886(828)	1	FS	250	CONCRETE	INCIDENTAL OVERFLOW FROM T-22	ABANDONED	1978	?	-
T-22	NA	TANKS 440, 449	886(828)	2	AG	250	STAINLESS	T440-BLDG 886 Room 101 & 103 WASTE T449-FISSILE URANIUM WASTE	ABANDONED	1978	#00039, #000294	- -
T-27	NA	PORTABLE LIQUID DUMPSTER	886	1	AG	500	STEEL	FROM T-22, BLDG 886	REMOVED	JULY 1989	-	-
T-24	NA	T-183, 184, 185, 802A, 802B, 802C, 802D	881(887)	7	AG	2,700	STEEL	BLDG 881 WASTE	ACTIVE/RCRA		-	#40.20-40.26
T-32	NA	BLDG 881 PROCESS WASTE PIT	881(887)	1	SUMP	131,160	CONCRETE	BLDG 881 WASTE	ACTIVE/INCIDENTAL SPILL CONTROL		-	SCR #2014
T-29	NA	T-207	SOUTH 774	1	ON-GRADE	200,000	STEEL	UNTREATED 774 WASTE	ABANDONED	1985	#00198, NDT-1184	#40

NOTES:

AG = aboveground
Bldg. = Building
gal = gallons
ID = Identification
NOS = Numbers
RCRA = Resources Conservation and Recovery Act
UG = underground
FS = Floor Sump
* = currently inactive and undergoing 90-day closure for subsequent reuse

TABLE 1-3
POTENTIAL OPWL INTERACTIONS WITH OTHER RFP OPERABLE UNITS

TANK	POTENTIAL INTERACTION WITH OTHER OUs
T-1	None
T-2	T-2 and T-3, a single, interconnected group of tanks, are also IHSS 122 (Underground Concrete Tanks), that has been incorporated into OU9 from OU13. 122 targets suspected leaks from T-2 and T-3. The IAG specifies a surface radiation survey and analysis of soil boring samples of HSL volatiles, nitrate, and various radio-nuclides at 122.
T-3	T-2 and T-3 are a single, interconnected group of tanks: see T-2 comments
T-8	IHHS 159 (Radioactive Site - Building 559), OU8, is immediately north of T-7. 159 targets process wasteleaks from pipelines on the east side of Building 599. These pipelines transferred process waste to T-7 from 559. The IAG specifies a surface radiation survey and analysis of soil boring samples for HSL volatiles and various radionuclides and metals at 159. This Work Plan proposes that IHSS 159 be incorporated into OU9.
T-8	T-8 is also IHSS 126 (Out-of-Service Process Waste Tanks), OU8. 126 targets suspected leaks from T-8. The IAG specifies analysis of soil boring samples for HSL volatiles, various radionuclides, beryllium and nitrate at 126. An alluvial ground water monitoring well north of the 126 site is also specified. This Work Plan proposes that IHSS 126 be incorporated into OU9.
T-9, T-10	T-9 and T-10 are also IHSS 132 (Radioactive Site #4 - 700 Area), OU8. 132 targets suspected leaks from T-9 and T-10. The IAG specifies analysis of soil boring samples for nitrate and various radionuclides at 132. This Work Plan proposes that IHSS 132 be incorporated into OU9. T9 and T-10 are possibly located within IHSS 131 (Radioactive Site #1 - 700 Area), OU14. 131 targets an area north and/or west of Building 776 (the precise location has not been determined) contaminated by plutonium during a 1959 fire. The IAG specifies analysis of soil boring samples for various radionuclides at 131.

TABLE 1-3
POTENTIAL OPWL INTERACTIONS WITH OTHER RFP OPERABLE UNITS

T-9, T-10 (cont.)	IHSS 118.1 (Multiple Solvent Spills West of Building 730), OU8, is located immediately west of the building which houses T-9 and T-10. 118.1 is the former location of an underground carbon tetrachloride storage tank which may have leaked during its operating history. The tank was removed in 1981. The IAG specifies a soil gas survey of 118.1, with soil borings where the survey detects contamination.
T-11, T-30	None (T-11 and T-30 are active, permitted RCRA waste units)
T-14, T-16	T-14 and T-16 consist of three inactive process waste tanks (designated T66, T67, and T68) located on the east side of Building 774. Two other IHSSs also address these tanks. IHSS 124 (Radioactive Liquid Waste Storage Tanks), is comprised of three subparts (124.2, 124.2, and 124.3) which target T66, T67, and T68, respectively. IHSS 125 (Holding Tank), also targets tank T66. IHSSs 124 and 125 have incorporated in to OU9.
T-21, T-22	IHSS 164.2 (Building 886 Radioactive Spills), OU14, targets uranium contamination in soil around and beneath Building 886. 164.2 appears on location maps to focus on the eastern side of 886, whereas T-21 and T-22 are immediately west of 886. The IAG specifies a surface radiation survey and analysis of soil boring samples for HSL volatiles, HSL semi-volaties and various radionuclides at 164.2.
T-27	T-27 is immediately adjacent to T-21 and T-22; see T-21, T-22 comments.
T-29	Chromate contamination related to IHSS 137 (Cooling Tower Blowdown, Building 774), OU8 may affect soils on the northwest side of T-29.

be used to identify areas of contamination requiring further investigation. The rationale for placement of sample locations is described in Section 3.1, Sampling Rationale.

The Stage 2 investigation, to be conducted at a future date, will determine the horizontal and vertical extent of contamination in vadose zone soils around OPWL tank locations identified as contaminated during Stage 1 activities. Stage 2 sampling activities will be based on Stage

1 sampling results and will be addressed in a future technical memorandum that will describe the recommended additional sampling in detail.

Depending on the Stage 1 sample results, Stage 2 investigations may consist of the following types of sampling activities:

- soil boreholes and soil samples;
- soil samples for physical analyses;
- groundwater monitoring well installation;
- asphalt and concrete samples;
- soil-gas surveys; and
- surface soil sampling.

Stage 2 investigations will be the subject of a future technical memorandum.

Approved By:

	Director	/ / *(Date)*
	Project Manager	/ / *(Date)*
TITLE: Operable Unit 9 Technical Memorandum No.1 Volume I, Part A	*Quality Assurance Program Manager*	/ / *(Date)*

2.0 PRELIMINARY FIELD ACTIVITIES

Preliminary field activities for the Stage 1 investigation of outside tanks include a limited data compilation, site walks, and utility clearances. Of these, the data compilation and site walks have been completed. The utility clearances are proposed to be completed before any sampling is performed. Each activity is discussed below.

2.1 DATA COMPILATION

Data compilation consisted of reviewing available information on OU9 OPWL. The data compilation task included a review of available engineering drawings, photo logbooks of Tank T-7 and the concrete pad at Tank T-27, the Historical Release Report (HRR) (DOE 1992b), the RCRA Post-Closure Care Permit Application (DOE 1988), OU9 Work Plan, and limited interviews with personnel involved with RFP process operations who were available at the time of site walks.

Since data for most tanks are complete, no other records for tanks were reviewed to supplement this Technical Memorandum. The records review will be used primarily to gather additional information for OPWL pipelines. If additional pertinent information on tanks is obtained during records review for pipelines, the new information will be incorporated into the tank investigation during Stage 2 activities.

2.2 SITE WALKS

Site walks for the outside tanks were conducted between July 29,1993 and August 13, 1993. The site walks identified:

- locations of structural features such as overhead or underground piping, visual utilities, valves vaults, manways to tanks, etc.;

- areas where construction activities may have disturbed OPWL components or IHSS specific features;

- logistical problems associated with field sampling activities such as security requirements, heavy equipment access restrictions, interference with RFP operations, health and safety concerns, or other difficulties in accessing areas for sampling; and

- obvious signs of contamination from leaks of operations associated with the tanks.

Information from the site walks was used to locate sample points where impact to Plant activities would be minimized and visible utilities would not pose an access problem. Specific care was given to identifying sample locations that were accessible by a truck-mounted drill rig.

During site walks, several precautions for field activities were noted. These were confirmed with engineering drawings for the tank areas and are described below.

Tank T-3. The OU9 Work Plan shows only one tank at this location. However, an engineering drawing (D21641-39) that was acquired during data compilation activities, shows that the above-grade T-3 tank lies directly over a below-grade T-3 tank. The underlying tank extends past T-3 on its western side. Precautions must be taken to locate the T-3 concrete

cover by probing the underlying soils prior to any intrusive activities to avoid drilling into the T-3 tank.

Tanks T-21 and T-22. The engineering drawings do not show an entrance to the last T-22 tank in the concrete vault. Access to this tank may be obtained by lifting the concrete slab that overlies the tank vault. It is anticipated that a crane or boom-truck will be needed to lift and move the concrete lid. However, to avoid breaking the seal on the concrete lid, residue and/or wipe sampling will be conducted, if possible, through the piping located on the northeast corner of the tank vault.

A building foundation drain pipe (for Building 886) is located around the north, east, and west sides of the concrete vault. Precautions must be taken to avoid drilling into this drain pipe.

2.3 UTILITY CLEARANCE

Utility clearances will be performed by Rocky Flats Plant construction personnel; clearance will be obtained for all boreholes prior to drilling. Existing information on OPWL locations and the utility maps indicates that a complex matrix of utilities surrounds the OPWL. Placement of selected borehole locations may be difficult at times due to existing utilities. Because of this, borehole locations may need to be off-set from the original location. Information on the off-set location and reasons for off-setting will be written into the OU9 Field Log Book and will be included in TM No. 2 that documents the results of Stage 1 activities.

Approved By:

	Director	/ / *(Date)*
	Project Manager	/ / *(Date)*
TITLE: Operable Unit 9 Technical Memorandum No.1 Volume I, Part A	*Quality Assurance Program Manager*	/ / *(Date)*

3.0 SAMPLING - OUTSIDE TANKS

The historical use of each tank and the available data were used to develop sampling strategies. Historical information presented in the HRR (DOE 1992b) and the OU9 Work Plan provides general indications of the types of compounds that may be anticipated at each tank location. Soil contamination may have resulted from historical spills, tank and pipeline leaks or improper storage of hazardous materials. Asphalt paving, concrete, or soil regrading occurred after many of the historically reported incidents, removing visible evidence of spills or possible releases. Additionally, contaminated soils may have been excavated or cleaned up.

3.1 SAMPLING RATIONALE

The sampling rationale that has been developed will provide an approach to accomplishing the objectives of the IAG and the OU9 Work Plan. (See Appendix A for IAG and OU9 Work Plan requirements.) Phase I sampling activities at OU9 will be conducted in two stages. Stage 1 sampling activities are designed to detect areas of contamination in OU9 vadose zone soils. Although not in the OU9 Work Plan, the saturated zone will be characterized to a limited extend by collecting groundwater, where possible, using the HydroPunch® method. Stage 2 activities will determine horizontal and vertical extent of contamination in vadose zone soils identified as contaminated during Stage 1. Information

acquired from RFP process personnel and physical constraints identified during site walks were considered when determining the proposed sample locations for Stage 1 activities.

To ensure that sufficient and adequate data are collected, the Phase I RFI/RI for OU9 is based on a staged approach where initial sampling activities are used to identify areas requiring additional investigation. OPWL structural features, historical release reports, field observations, and conceptual model release scenarios will be used to identify primary sampling locations. Analytical results from these sampling activities will be used to identify areas of contamination requiring further investigation. These areas will be further sampled to provide an assessment of the extent of contamination in soils.

Two types of activities will be performed during the Phase I field investigation: (1) field screening activities, and (2) sampling activities. Screening activities (Levels I and II; see Appendix B) include visual inspection and radiological surveys. Sampling activities (Levels IV and V; see Appendix B) include analysis of surficial soils, subsurface materials from soil borings, groundwater from HydroPunch® sampling, and residue from pipelines and tanks.

Sampling options for the Phase I RFI/RI were selected on the basis of their ability to provide adequate data to characterize the contaminant sources and the soil. The lack of available data for OU9 mandates a comprehensive sampling program to ensure that adequate source characterization is achieved. However, the large expanse of OU9 dictates that the sampling program be properly focused to collect only those samples required to achieve source characterization. The staged sampling approach provides a logical means of obtaining a thorough characterization while minimizing the number of samples required.

Analytical options were selected to obtain data meeting the data quality objectives (DQOs) and the precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters discussed in the OU9 Work Plan (EG&G 1992). The DQOs and the Quality Assurance Sections of the OU9 Work Plan are found in Appendix B and C, respectively.

OU9 OPWL components include above-grade, on-grade, and below-grade tanks. In general, the multi-task survey and sampling approach described below will be used to determine the potential source locations for each tank.

3.1.1 Surface Radiation Surveys

Surface radiation surveys will be conducted to assess radioactive contamination of surficial materials. Radiological survey techniques for surface soils will include high purity germanium (HPGe) surveys supplemented with sodium iodide (NaI) surveys. HPGe surveys will be conducted on 25-foot grids using the tripod method. (See Section 4.0, Field Procedures.) The HPGe survey will be conducted first because it provides greater areal coverage and higher quality results. The HPGe gamma ray detector that will be used is capable of high resolution gamma ray spectroscopy enabling the identification and quantification of gamma-emitting radionuclides. The NaI survey will consist of performing a 4-foot-grid survey with NaI detector to delineate specific radioactivity anomalies detected by the HPGe survey. The NaI instrument will be swung back and forth within the 4-foot grid area to achieve total coverage. The number of locations included in the NaI surveys will be based on the HPGe results.

A prework health and safety radiation survey of borehole locations will also be conducted to assess radioactive contamination. Surveys will be conducted using the NaI instrument.

Health and safety radiation surveys will be conducted in accordance with Environmental Management Department (EMD) Operating Procedure (OP) FO.16, Field Radiological Measurements.

3.1.2 Tank Inspections

Tanks will be inspected, where possible, to visually identify structural failures where past releases or potential releases to the environment have occurred. The inspections will be conducted in accordance with OPs FO.28, Tank and Pipeline Investigations for RFI/RIs. If the results of the inspection identify potential release areas that are not targeted for sampling under this Technical Memorandum, then additional samples may be recommended for future Stage 2 sampling activities or as samples of opportunity under Stage 1 activities.

Tank inspections will be conducted from manhole openings where permissible to avoid entry into the tanks.

3.1.3 Residue or Wipe Sampling

To help characterize OPWL wastes, residue samples will be collected from each abandoned tank that has not been cleaned since its removal from process waste service. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank (preferably at the base of the tank or near pipeline connections). This will provide a quantitative measure of radionuclide contamination. Where possible, residue or wipe samples will be collected remotely to mitigate the need for entry into confined spaces. Copies of portions of engineering drawings that detail the specific locations (manways, pipes, etc.) for sampling are found in Appendix D.

3.1.4 Incidental Water Sampling

Although incidental water sampling was not included in the OU9 Work Plan (EG&G 1992), sampling of incidental (surface water or groundwater) will be conducted to characterize potential contamination of valve vaults.

3.1.5 Surface Soil Sampling

Although not included in the OU9 Work Plan, surface soil samples will be collected at suspected contamination release locations, such as potential locations of surface spills or leaks that were identified during site walks. Two types of surface soil samples will be collected: surface soil composite using the Rocky Flats (RF) method and surface soil grab. The surface soil composite sample is used to determine if contamination is present from past spills that may have affected a large area. The surface soil grab sample is collected at a specific location where leaks may have occurred in a smaller concentrated area such as under a valve.

As specified in the OU9 Work Plan, surface soil samples will also be collected at each soil boring location.

3.1.6 Soil Boreholes

Boreholes will be drilled and sampled to identify areas of contamination adjacent to a tank location. As discussed in the OU9 Work Plan, contamination will most likely exist at the following locations around OPWL tanks:

- beneath or near external connections and openings;
- near joints or corners around underground tanks; and
- beneath the base of the tank.

Areas beneath or near external connections and openings, and near joints or corners around underground tanks, will be targeted as primary borehole locations. As a general rule, boreholes will be drilled on each accessible side of the tank or vault, as closely as possible to the tank or vault. For locations where the tanks were removed, a single borehole will be drilled as closely as possible to the center of the original tank location. Where multiple

tanks existed at a single location, boreholes will be drilled at the original center of each individual tank location. Although not in the OU9 Work Plan, if former underground storage tanks that have been removed were enclosed within a vault, an additional sample will be collected from a point of opportunity along the outside perimeter of the vaults at the depth of the bottom of the vault. In general, three soil samples will be collected from each borehole (EG&G 1992). Appendix C presents Tank Soil Sampling Locations (Figure 7-6) from the OU9 Work Plan (EG&G 1992). For below-grade tanks, the samples will be collected at the following depths and submitted for analysis:

- ground surface (before drilling);
- 1 foot below the base of the tank (if the base of the tank is in bedrock or if the water table is not encountered and the distance from the base of the tank to the alluvium/bedrock contact is less than 5 feet, this sample will be omitted);
- directly above the water table or bedrock/alluvium contact, whichever is encountered first; and
- 1 foot below the bedrock/alluvium contact or at refusal if bedrock is encountered before the water table.

For above-grade or on-grade tanks, samples will be collected at the following depths and submitted for analysis:

- ground surface (before drilling);
- mid-depth between the ground surface and the water table or bedrock/alluvium interface, whichever is encountered first (if the depth between the ground surface and

the water table or bedrock is less than 5 feet at above-grade tank locations, the mid-depth soil sample will be omitted); and

- directly above the water table or bedrock/alluvium contact, whichever is encountered first.

In areas where previous analytical results have indicated the presence of contamination, samples will be collected at the following areas and submitted for analysis:

- ground surface (before drilling);
- composite samples at each 2-foot interval to a depth of 10 feet below the base of the tank, or until the water table or bedrock is encountered; and
- 1 foot below the bedrock/alluvium contact or at refusal, if bedrock is encountered before the water table.

All sample locations are described and shown in Section 3.2 figures.

3.1.7 Groundwater Sampling

Groundwater sampling, using a HydroPunch® sampler or equivalent in soil boreholes drilled into the saturated zone, will be conducted to characterize potential contamination of the groundwater.

3.2 SAMPLE LOCATIONS AND FREQUENCY

This section describes the specific field investigations proposed for each tank/IHSS including sample locations and intervals. Table 3-1 shows the number and type of samples for each

TABLE 3-1
SAMPLE, MEDIA, QUANTITY, AND ANALYTES
OU9 ORIGINAL PROCESS WASTE LINES

TANK No.	DUPLICATE IHSS No.	TANK INSPECTION	HPGe/NaI SURVEY	RESIDUE OR WIPE (1)	VAULT WATER (2)	GROUND-WATER (2)	SURFACE SOIL	BOREHOLE/ SOIL SAMPLES	SAMPLE ANALYTE							
									METALS	VOLs	SEMI-VOLs	RAD	WQ	PCBs	PEST.	HERB.
T-1	NA	NO	9/TBD	0	0	1	0	1/2	X	NA	NA	X	X	NA	NA	NA
T-2, T-3,	IHSS 122	YES (T-3)	9/TBD	3 (T-2) 1 (T-3)	3 (T-2)	5	5-GRAB 6-RF	5/15	X	X	X	X	X	X	NA	NA
T-7	IHSS 159	NO	8/TBD	0	0	4	0	4/12	X	X	X	X	X	X	X	X
T-8	IHSS 126	Active fire plenum tanks - no investigation proposed.														
T-9	IHSS 132	Active fire plenum tanks - no investigation proposed.														
T-10	IHSS 132	YES	12/TBD	2	0	4	0	4/12	X	X	X	X	X	NA	NA	NA
T-11, T-30	Active secondary containment unit - no investigation proposed.															
T-14, T-16	IHSSs 124 and 125	YES	12/TBD	1 (T-14) 2 (T-16)	0	5	0	5/25	X	X	X	X	X	NA	NA	NA
T-15, T-17	IHSS 146	NO	see T-14, T-16	0	0	see T-14, T-16	see T-14, T-16	0	X	X	X	X	X	NA	NA	NA
T-21, T-22	NA	YES	9/TBD	1 (T-21) 2 (T-22)	2	4	0	4/12	X	X	X	X	X	NA	NA	NA
T-27	NA	NO	see T-21, T-22	0	0	0	3	0	X	X	X	X	NA	NA	NA	NA
T-24	Active RCRA interim status unit - no investigation proposed.															
T-32	Active secondary containment unit - no investigation proposed.															
T-29	NA	YES	10/TBD	2	1	4	2 GRAB	4/12	X	X	X	X	X	NA	NA	NA
TOTAL				14	6	27	16	27/90								

Notes:
(1) If no residue is present, a wipe sample will be collected. Wipe samples will be analyzed only for qualitative radiological analysis.
(2) Sample collected only if water is encountered.

Herb = Herbicides
HPGe = High purity Germanium
IHSS = Individual Hazardous Substance Site
NA = Not applicable
NaI = Sodium Iodide, conducted only if HPGe data indicate anomalies
No = Number
PCBs = Polychlorinated biphenyls
Pest. = Pesticides
Rad = Qualitative radiological analysis
RF = Rocky Flats Method
TBD = to be determined in the field based on HPGe results
Vols = Volatiles
WQ = pH, specific conductivity, selected anions (nitrate/nitrite, sulfate, chloride, fluoride), total organic carbon (only for water samples)
X = analytes to be tested

outside tank within OU9. The exact number of samples collected may change based on field conditions such as the location of utilities in the area, depth to bedrock, depth to the water table, and presence of groundwater. The number of NaI surveys required will depend on the results of the HPGe surveys, and those exact numbers cannot be determined at this time. Stage 1 sampling activities are based on present tank conditions (assessed during site walks) and historical use, and are designed to define the nature of contamination at the tank.

3.2.1 Tank T-1

Tank T-1 is an 800-gallon, stainless-steel underground tank that was removed in January 1984. The tank was located in the 100 Area, outside of Building 122 (the Medical Facility). It held waste streams from Building 122. The former tank area has been identified as a known release location. The primary waste streams were trace radionuclides and decontamination water (that included waste such as bleach, soap, blood, and hydrogen peroxide).

As part of the Stage 1 activities an HPGe radiological survey will be conducted on 25-foot grids using the tripod-mounted procedure. If the results of the HPGe survey show anomalies, then a NaI survey will be conducted using 4-foot grids.

One soil borehole will be drilled as closely as possible to the center of the original tank location. Two soil samples from the borehole will be collected at the following locations: 1 foot below the location of the base of the former tank (estimated at 11 to 15 feet below ground surface), and directly above the water table (estimated at 12 feet below ground surface). The soil sample in the unsaturated zone will confirm whether uncontaminated backfill was used when the tank was removed. The sample collected below the base of the former tank will be from native soil. The ground surface sample will not be collected since this consists of uncontaminated fill dirt. Sample locations are presented in Figure 3-1.

If groundwater is encountered in the borehole, a HydroPunch® or equivalent will be used to collect groundwater samples. Soil and groundwater samples will be analyzed for Target Analyte List (TAL) metals and radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Groundwater will also be analyzed for water quality parameters that include pH, specific conductivity, nitrate/nitrite, sulfate, chloride, fluoride, and total organic carbon (TOC).

3.2.2 Tanks T-2 and T-3

Tanks T-2 and T-3 are interconnected tanks located in the 400 Area, outside of Building 441. This location is also designated as IHSS 122. Tank T-2 is a 3,000-gallon, underground concrete tank located under Building 441. Tank T-2 is also associated with three concrete vaults. Tank T-3 consists of one 3,200-gallon, above-grade steel tank, and one 3,000-gallon, underground concrete tank. One tank at T-3 is identified in the OU9 Work Plan; however, an engineering drawing (D21641-39) obtained during site walks shows two tanks at this location. All three tanks were abandoned in June 1982. These tanks received waste streams from Building 122 (the Medical Facility), Building 123 (the Health Physics Analytical Laboratory), and Building 441 (the Analytical Laboratory). The locations of Tanks T-2 and T-3 have been identified as known release locations. Waste streams included acids, bases, solvents, radionuclides, metals, thiocyanate, ethylene glycol, trace polychlorinated biphenyls (PCBs), bleach, soap, blood, and hydrogen peroxide.

Stage 1 activities will include a visual tank inspection of the above-grade tank and the concrete vault at Tank T-3. No inspections will be conducted of the underground Tank T-2. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe show anomalies, then a NaI radiological survey will be conducted on 4-foot grids.

One residue sample will be collected from the above-grade tank. If no residue is present, one wipe sample will be taken from the tank interior for a qualitative radiological analysis. If there is groundwater in the concrete vaults, water samples will be collected. If no water is encountered in the vaults, one wipe sample will be collected from the interior walls of each of the vaults. (Reference Appendix D for vault and tank access ports for residual sampling.)

Five surface soil grab samples will be collected from potential spill or leak release locations around Tank T-3; three from discrete locations underneath the above-grade tank and two from pipe valve connections where leaks were likely to have occurred. Six composite samples will be collected using the RF method for radiological analyses from areas around the tanks where surface spills from tank overflow may have occurred.

Five soil boreholes will be drilled around the tank location. Three soil samples from each borehole will be collected from the following locations: ground surface (before drilling), 1 foot below the base of the tank(s) (estimated at 8 to 10 feet below ground surface), and directly above the water table (estimated at 10 feet below ground surface).

If groundwater is encountered in the boreholes, a HydroPunch® sampler or equivalent will be used to collect groundwater samples. Sample locations are presented in Figure 3-2.

Vault water, groundwater, soil, and residue samples will be analyzed for radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analyses include Target Analyte List (TAL) metals; target compound list (TCL) volatiles; TCL semivolatiles; PCBs; and water quality parameters that include pH, specific conductivity, quantities of groundwater, nitrate/nitrite, sulfate, chloride, fluoride, and TOC. The wipe sample will be analyzed for quantitative radionuclides. In the event that the water table yields insufficient quantities of groundwater using the HydroPunch® sampler, groundwater will be collected based on the following

priority: TCL volatiles, radionuclides, water quality parameters, TCL semi-volatiles, PCBs, and metals.

3.2.3 Tank T-7

Tank T-7 is located in Building 528 (the Building 559 Process Waste Pit). This location is also designated as IHSS 159. Tank T-7 comprises two 2,000-gallon, in-sump steel tanks that are situated in an underground concrete vault. Waste streams for Tank T-7 were from Building 559, (the Analytical Laboratory) and included acids, bases, solvents, radionuclides, metals, pesticides, herbicides, and potentially PCBs. Tank T-7 has been identified as a known release location at its connection with Pipe P-16.

According to building personnel, the tanks are currently undergoing operational closure and will be subsequently reused to drain building sinks, if clean closure is achieved. The tanks were used as 90-day transuranic waste tanks. The contents of the tanks were sampled by RFP Building personnel (August 1993) to characterize closure requirements. Results of the tank characterization and closure requirements are not currently available but will be reviewed to determine the need for future sampling. Sample results will be incorporated into Technical Memorandum No. 2.

Although this tank may be reused in the future, it is currently inactive and, therefore, will be investigated as part of the RFI/RI activities. Stage 1 activities will include an HPGe radiological survey. If the results of the HPGe detect anomalies, then a NaI radiological survey will be conducted on 4-foot grids.

A total of four soil boreholes will be drilled: one borehole at each accessible side of the tank concrete vault containing the T-7 tanks. Three soil samples from each borehole will be collected at the following locations: surface sample (0 to 6 inches), 1 foot below the base

of the tanks (estimated at 22 to 25 feet below ground surface), and directly above the water table (estimated at 5 to 8 feet below ground surface).

If groundwater is encountered in the boreholes, a HydroPunch® sampler or equivalent will be used to collect a groundwater sample. Due to the ongoing tank characterization being conducted by Building 559 personnel, no visual inspections or residue or wipe samples are proposed since the results of the current tank characterization will be incorporated when they are available. Also, information on past sampling conducted in this area in 1968 and 1972 will be reviewed to supplement any additional sampling, if needed, in Stage 2. Sample locations are presented in Figure 3-3.

Soil and groundwater samples will be analyzed for radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analysis include TAL metals; TCL volatiles; TCL semivolatiles; PCBs; pesticides; herbicides; and water quality parameters that include pH, specific conductivity, nitrate/nitrite, sulfate, chloride, fluoride, and TOC. In the event that the water table yields insufficient quantities of groundwater, samples will be collected based on the following priority: TCL volatiles, radionuclides, water quality parameters, TCL semivolatiles, PCBs, radionuclides, metals, pesticides, and herbicides.

3.2.4 Tank T-8

Tank T-8 is located in Building 728 (the Building 771 Process Waste Pit). This location is also designated as IHSS 126. Tank T-8 consists of two 25,000-gallon underground tanks. The tanks were taken out of service in May 1984, cleaned and painted, and converted to plenum deluge catch tanks for fire-water from Building 771.

Since the tanks now are actively used as plenum catch tanks, the investigation of these tanks will be deferred to a later date.

3.2.5 Tanks T-9 and T-10

Tanks T-9 and T-10 are located in Building 730 (the Building 776 Process Waste Pit). This location is also designated as IHSS 132. Tank T-9 consists of two 22,550-gallon, underground concrete tanks with the dimensions of 25 feet by 15 feet by 10 feet. Tank T-9 is known as the Laundry Waste Holding Tanks. These tanks were taken out of service in October 1984, cleaned and painted, and converted to plenum deluge catch tanks. Since the T-9 tanks are active, the investigation of these tanks will be deferred to a later date.

Tank T-10 consists of two 4,500-gallon, underground concrete tanks with the dimensions of 5 feet by 5 feet by 10 feet. These tanks are the Process Waste Holding Tanks and were abandoned in December 1982; however, they have not been cleaned or painted since being removed from service. Waste streams for Tank T-10 were from Building 776 (Production Support) and Building 778 (Laundry). Waste streams included radionuclides, solvents, metals, and small amounts of machinery and lubricating oils. Releases from the tanks are considered likely due to the condition of the tanks.

Stage 1 activities will include a visual inspection of Tank T-10. An HPGe survey radiological survey will be conducted around the tank locations. If the results of the HPGe show anomalies, then a NaI radiological survey will be conducted on 4-foot grids.

One residue sample will be collected from each of the Tank T-10 tanks that have not been cleaned and painted. If no residue is present, then one wipe sample will be taken from the tank interior for radiological analysis. (Reference Appendix D for access ports for residue sampling.)

A total of four soil boreholes will be drilled: one borehole at each accessible side of the concrete vault containing the tanks. The borehole proposed along the west side of the tank location will be offset slightly to the south to avoid interference with the location of a leaking underground storage tank containing solvent (IHSS 118.10) that is being investigated under OU8. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), 1 foot below the base of the tanks (estimated at 26 to 29 feet below ground surface), and directly above the water table (estimated at 11 to 15 feet below ground surface). If groundwater is encountered in the boreholes, a HydroPunch® sampler or equivalent will be used to collect a groundwater sample. Sample locations are provided in Figure 3-4.

Soil, groundwater, and residue samples will be analyzed for radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Tritium will be analyzed in groundwater samples. Chemical analyses include TAL metals; TCL volatiles; TCL semi-volatiles; and water quality parameters that include pH, specific conductivity, nitrate/nitrite, sulfate, chloride, fluoride, and TOC. Wipe samples will be analyzed for quantitative radionuclides. In the event that the water table yields insufficient quantities of groundwater, samples will be collected based on the following priority: TCL volatiles, radionuclides, water quality parameters, TCL volatiles, TCL semivolatiles, radionuclides, and metals.

3.2.6 Tanks T-11 and T-30

Tanks T-11 and T-30 are located in Building 731 (the Building 707 Process Waste Pit). Tank T-11 consists of two 2,000-gallon closed-top sumps. Tank T-30 is one 23,113-gallon, underground concrete sump. Both Tanks T-11 and T-30 are active incidental spill control units.

Since the tanks are actively used as secondary containment units, the investigation of these tanks will be deferred to a later date.

3.2.7 Tanks T-14 and T-16

Tanks T-14 and T-16 are located on the east side of Building 774 in a chemical storage shed. This is the same location as IHSSs 124.1 through 124.3, and IHSS 125. Tank T-14 consists of one 30,000-gallon underground concrete tank. Tank T-16 consists of two 14,000-gallon underground concrete tanks. Tank T-14 and Tank T-16 are designated as RFP Tanks 68, 66, and 67, respectively. Previous data indicate the tanks were abandoned in November 1989. Other data (DOE 1992b) indicate the tanks were to be closed in compliance with RCRA closure requirements. However, these tanks were reportedly removed from the list of RCRA-permitted or RCRA interim-status tanks before closure was conducted and transferred to OU9.

Tanks T-14 and T-16 received waste streams from Building 774 (the Process Waste Treatment Facility). Waste streams included acids, bases, radionuclides, metals, and other wastes used at RFP. Both Tanks T-14 and T-16 have been identified as release locations where tank overflow was documented in 1980 and 1981. The HRR (DOE 1992b) indicates that radiation surveys were conducted from 1977 to 1984. These results will be evaluated for a future technical memorandum.

Stage 1 activities will include a visual inspection of each tank. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe survey detect anomalies, then a NaI radiological survey will be conducted on 4-foot grids.

One residue sample will be collected from each tank. If no residue is present, then one wipe sample will be collected from each of the tank's interior surface for radiological analysis. (Reference Appendix D for access ports for residue sampling.)

Five soil boreholes will be drilled topographically downslope of the tank locations. Since contaminated soil has been detected in this area, five soil samples from each borehole will be collected at the following locations: ground surface (before drilling); and one composite sample at each 2-foot interval to a depth of 10 feet below the base of the tanks, or until the water table or bedrock is encountered. The water table at this location is estimated to be at 5 to 8 feet below ground surface. Therefore, it is estimated that samples will be collected from depths of 2, 4, 6, and 8 feet in each borehole.

Composite sampling is not included in the OU9 Work Plan, however, this sampling is consistent with the sampling requirements specified in the IAG. Since previous contamination has been detected, five samples rather than three will be collected from each borehole. If groundwater is encountered in the boreholes, a HydroPunch® sampler or equivalent will be used to collect a groundwater sample. Sample locations are shown in Figure 3-5.

Soil, groundwater, and residue samples will be analyzed for radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Tritium will be analyzed in groundwater samples. Chemical analyses include TAL metals (including hexavalent chromium and tantalum), TCL volatiles, and TCL semivolatiles; and water quality parameters that include pH, specific conductivity, nitrate/nitrite, sulfate, chloride, fluoride, and TOC. Wipe samples, if collected, will be analyzed for quantitative radionuclides. In the event that the water table yields insufficient quantities of groundwater, samples will be collected based on the following priority: TCL volatiles, radionuclides, water quality parameters, TCL semivolatiles, radionuclides, and metals.

3.2.8 Tanks T-15 and T-17

Tanks T-15 and T-17 were located beneath the south wing of Building 774. This location is also designated as IHSS 146. Tank T-15 consisted of two 3,000-gallon underground concrete tanks. Tank T-17 consisted of four 6,000-gallon underground concrete tanks. All tanks were taken out of service and removed when the south wing of Building 774 was built in 1972. The south wing overlies the former tank locations. Tanks T-15 and T-17 have been identified as known release locations. Contaminated soil from this area was removed in 1972 during construction of the south wing. The contaminated soil was piled north of Building 334 (currently IHSS 156.1), and later moved to the area called the triangle area (IHSS 165). Sixty yards of contaminated soil from Building 774 were also used as fill dirt east of Building 881 (currently IHSS 130). IHSSs 156.1 and 165 and Building 881 are being investigated under other OUs.

Stage 1 activities for Tanks T-15 and T-17 are included with those described for Tanks T-14 and T-16 because of their proximity. These activities will include an HPGe radiological survey. If the results of the HPGe detect anomalies, a NaI radiological survey will be conducted on 4-foot grids. Since soil boreholes will be drilled directly east of the south wing for Tanks T-14 and T-16, no additional soil boreholes are proposed for Stage 1 activities as these locations should detect any historical releases from Tanks T-15 and T-17. Tanks T-15 and T-17 are shown in Figure 3-5.

Future Stage 2 activities will be used to further define potential areas of contamination and differentiate potential contamination from Tanks T-14 and T-16, and Tanks T-15 and T-17.

3.2.9 Tanks T-21 and T-22

Tanks T-21 and T-22 are located in Building 828 (the Building 886 Process Waste Pit). Tank T-21 is a 250-gallon, concrete floor sump. Tank T-22 consists of two 250-gallon, steel tanks that are situated in an underground concrete vault. Tanks T-21 and T-22 held waste from the laboratories in Building 886. Waste streams included radionuclides, laboratory soaps, janitorial cleaning fluids, and possibly nitrates. Tank T-21 held overflow from Tank T-22 and groundwater infiltrating Building 828. The tanks were abandoned in 1978. There are no known releases at this location.

Stage 1 activities will include a visual tank inspection of the tanks. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe detect anomalies, a NaI radiological survey will be conducted on 4-foot grids.

One residue sample will be collected from each tank and from the sump. If no residue is present, one wipe sample will be taken from the interiors of the tanks and sumps for radiological analysis. If groundwater has filled the pit or tanks, a water sample will be collected. (Reference Appendix B for access ports for residue sampling.)

A total of four soil boreholes will be drilled: one borehole at each accessible side of the concrete vault containing Tanks T-21 and T-22. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), 1 foot below the base of the tanks (estimated at 20 to 25 feet below ground surface), and directly above the water table (estimated at 15 to 20 feet below ground surface).

If groundwater is encountered in the boreholes, a HydroPunch® sampler or equivalent will be used to collect a groundwater sample. Sample locations are shown in Figure 3-6.

Vault water, soil, and residue samples will be analyzed for radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and cesium 137. Chemical analyses include TAL metals; TCL volatiles; TCL semivolatiles; and water quality parameters that include pH, specific conductivity, nitrate/nitrite, sulfate, chloride, fluoride, and TOC. Wipe samples, if collected, will be analyzed for quantitative radionuclides. In the event that the water table yields insufficient quantities of groundwater, samples will be collected based on the following priority: TCL volatiles, radionuclides, water quality parameters, TCL semivolatiles, and metals.

3.2.10 Tank T-27

Tank T-27 is a 500-gallon portable tank that was located on a concrete pad outside of Building 886. The tank was used to store and transfer Building 886 process waste. Waste was pumped from Tanks T-21 and T-22 (described above) to Tank T-27 and transported, via truck, to the waste treatment facility. Tank T-27 was decontaminated, removed, and sent to the size reduction building for disposal after a state employee noted a wet area, approximately 4 to 5 inches in diameter, under the bottom drain valve of the tank.

Subsequently, radiation surveys were conducted on and around the concrete pad and soil from around the pad was collected and analyzed. Results of the soil samples showed only low levels of naturally occurring uranium. Nonremovable contamination detected on the pad was fixed in place with spray paint. At the time of the site walk, the area in the concrete was chipped out. Since Tank T-27 has been removed, the area of investigation for Tank T-27 is the concrete pad. Documentation obtained from Dr. Bob Rothe (of RFP's Critical Mass Laboratory Building 886) shows that soil samples around the pad indicate no radiological contamination as a result of the leak (Appendix F).

Stage 1 activities include an HPGe radiation survey to verify that no radiation contamination exists on or around the concrete pad. If anomalies are detected during the HPGe survey, an NaI survey will be conducted.

Three surface soil grab samples will be collected from around the concrete pad closest to the area of the former leaking valve. Soil samples will be analyzed radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; plutonium 239 and 240; and cesium 137. Chemical analyses include TAL metals; TCL volatiles; and TCL semivolatiles. The HPGe survey area and the surface soil samples are presented in Figure 3-6.

3.2.11 Tanks T-24 and T-32

Tanks T-24 and T-32 are located in Building 887 (the Building 881 Process Waste Pit). Tank T-24 consists of seven 2,700-gallon, above-grade steel tanks situated within Tank T-32, a concrete vault. Tank T-32 is a 131,160-gallon underground sump. Tank T-24 is an active RCRA unit (RCRA Unit Nos. 40.20 to 40.26). T-31 is the secondary containment for Tank T-24.

Since the tanks are actively used, the investigation of these tanks will be deferred to a later date.

3.2.12 Tank T-29

Tank T-29 is a 200,000-gallon, on-grade steel tank located south of Building 774 (Process Waste Treatment). Tank T-29 was used to store untreated process waste from Building 774. Records indicate that it was abandoned in the mid-1980s (DOE, 1992a). The waste stream from Building 774 included acids, bases, solvents, radionuclides, metals, chlorides, oils, and grease. There are no reported releases from this tank.

As part of Stage 1 activities a visual tank inspection will be conducted. An HPGe radiological survey will be conducted around the tank locations. If the results of the HPGe detect anomalies, a NaI radiological survey will be conducted on 4-foot grids.

Two residue samples will be collected; one from an open outflow pipe and one from the tank's manway opening. Two surface soil grab samples will be collected: one from under the open outflow pipe and one from beneath a pipe with a welded seam that indicates a rupture may have occurred.

A water sample may be collected from the valve vault north of Tank T-29 if groundwater is encountered in the vault.

Four soil boreholes will be drilled around the tank. Three soil samples from each borehole will be collected at the following locations: ground surface (before drilling), mid-depth between the ground surface and the water table, and directly above the water table (estimated at 8 to 10 feet below ground surface). If groundwater is encountered in the boreholes, a HydroPunch® sampler or equivalent will be used to collect a groundwater sample. Sample locations are presented in Figure 3-7.

Vault water, groundwater, and soil samples will be analyzed for radiological analyses that include gross alpha; gross beta; uranium 233, 234, 235, and 238; americium 241; and plutonium 239 and 240. Chemical analyses include TAL metals (including hexavalent chromium and tantalum); TCL volatiles; TCL semivolatiles; and water quality parameters that include pH, specific conductivity, nitrate/nitrite, sulfate, chloride, fluoride, and TOC. Wipe samples, if collected, will be analyzed for quantitative radionuclides.

In the event that the water table yields insufficient quantities of groundwater, samples will be collected based on the following priority: TCL volatiles, radionuclides, water quality parameters, TCL semivolatiles, and metals.

Approved By:

Director	*(Date)*
Project Manager	*(Date)*
Quality Assurance Program Manager	*(Date)*

TITLE:
Operable Unit 9
Technical Memorandum No.1
Volume I, Part A

4.0 FIELD PROCEDURES

Field procedures and required equipment for borehole drilling and soil sampling are specified in EMD OPs GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques. Before any boreholes are drilled, the location will be cleared for utilities in accordance with EMD OPs GT.10, Borehole Clearing. Boreholes will be abandoned in accordance with EMD OPs GT.05, Plugging and Abandonment of Boreholes. Communication in the field will be handled in accordance with EMD OPs FO.11, Field Communications.

Surface soil samples will be collected as specified in EMD OPs GT.08, Surface Soil Sampling. Equipment needed for surface soil sampling is specified in EMD OP GT.08. The locations of all boreholes and surface soil sampling points will be surveyed using standard land surveying techniques described in the EMD OPs GT.17, Land Surveying. Residue samples will be collected in accordance with EMD OPs FO.28, Tank and Pipeline Investigation For RFI/RI. Wipe samples will be collected and tested according to EMD OP FO.16, Field Radiological Measurements. The HydroPunch® groundwater samples will be collected according to EMD OPs GW.06, Groundwater Sampling. Incidental water samples from tank and valve vaults will be collected according to EMD OPs SW.16, Sampling of Incidental Waters.

Decontamination will be in accordance with EMD OPs FO.03, General Equipment Decontamination; and EMD FO.04, Heavy Equipment Decontamination. Disposal of

decontamination water will be in accordance with EMD OPs FO.07, Handling of Decontamination Water and Waste Water. Disposal of personal protective equipment will be in accordance with EMD OPs FO.06, Handling of Personal Protective Equipment. Sample labeling, shipment, and preservation will be conducted according to EMD OP FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples. Sample designations, documentation, data package preparation, and sample tracking will be in accordance with EMD OPs FO.14, Field Data Management. Transmittal of quality assurance (QA) records will be handled in accordance with EMD OPs FO.02, Transmittal of Field QA Records. A list of all EMD OPs applicable to Stage 1 sampling activities is presented in Table 4-1.

A summary of Phase I tank investigation sampling field methods is provided below. Details of the methods are given in the RFP operating procedures.

1. A radiation survey will be conducted at the work area according to OPs GT.30, In-Situ Characterization for Radionuclides. The radiation survey results must also satisfy the prework area radiation monitoring requirements of OPs FO.16, Field Radiological Measurements forms, and FO.16A and FO.16B must be completed. Radiological survey points will be surveyed with the use of a global positioning system (GPS) in accordance with OPs GT.27, Autonomous Operation of Global Positioning Equipment.

2. Utility clearances must be completed, before drilling begins, according to EMD OPs GT.10.

3. The following decontamination equipment must be assembled for field use as required by EMD OPs FO.03: liquinox, bristle brushes (all plastic), RFP tap water or distilled water, nonreactive plastic wrap, plastic wash and rinse tubs, plastic sheeting for use as a ground cloth, and paper towels.

TABLE 4-1
OPERATING PROCEDURES
OU9 ORIGINAL PROCESS WASTE LINES

Procedure	Name
EMD OPs GT.02	Drilling and Sampling Using Hollow-stem Auger Techniques
EMD OPs GT.05	Plugging and Abandonment of Boreholes
EMD OPs GT.08	Surface Soil Sampling
EMD OPs GT.10	Borehole Clearing
EMD OPs GT.17	Land Surveying
EMD OPs GT.27	In Situ Characterization for Radionuclides
EMD OPs GT.30	Autonomous Operation of Global Positioning Equipment
EMD OPs SW.02	Field Measurement of Surface Water Field Parameters
EMD OPs SW.16	Sampling of Incidental Waters
EMD OPs GW.06	Groundwater Sampling
EMD OPs ST.22	In Situ Sampling with BAT® Sampling
EMD OPs FO.02	Transmittal of Field QA Records
EMD OPs FO.03	General Equipment Decontamination
EMD OPs FO.04	Heavy Equipment Decontamination
EMD OPs FO.06	Handling of Personal Protective Equipment
EMD OPs FO.07	Handling of Decontamination Water and Wash Water
EMD OPs FO.11	Field Communications
EMD OPs FO.13	Containerization, Preserving, Handling and Shipping of Soil and Water Samples
EMD OPs FO.14	Field Data Management
EMD OPs FO.16	Field Radiological Measurements
EMD OPs FO.23	Management of Soil and Sediment Investigative Derived Material (IDM)
EMD OPs FO.28	Tank and Pipeline Investigation for RFI/RI

Notes:
OU = Operable Unit
EMD = Environmental Management Department
OPs = Operating Procedures
RFI/RI = RCRA Facility Investigation/Remedial Investigation
RCRA = Resource Conservation and Recovery Act

4. The following sampling equipment must be obtained as required by EMD OPs FO.13: sample glassware with preservative (as described in Section 5.0), coolers, thermometer, blue ice, sample labels, chain-of-custody forms, custody seals, zip-lock bags, bubble wrap, vermiculite, strapping tape, clear tape, and a carboy to transport rinsate.

5. Borehole drilling and sampling will be in accordance with EMD OPs GT.02.

6. Before and after drilling and sampling take place, all equipment must be decontaminated in accordance with the procedures outlined in the EMD OPs FO.03 and FO.04. Disposal of decontamination water shall be in accordance with EMD OPs FO.07.

7. Incidental water samples from the tank and valve vaults will be collected according to EMD OPs SW.02 and SW.16.

8. The HydroPunch® groundwater sampler will be used to collect grab groundwater samples from the top of the water table during borehole activities. The groundwater samples will be collected according to EMD OPs GW.06, Groundwater Sampling.

9. Surface soil samples will be collected according to EMD OPs GT.08. Two types of surface soil samples will be collected. The first type of sampling is the Rocky Flats (RF) Method. The RF method consists of compositing five soil samples collected from the center and each corner of two 1-meter squares that are spaced 1 meter apart at each sample location. The second type of surface soil sample is the grab sample which is collected from one discrete sample location.

10. Residual samples will be collected according to EMD OPs FO.28.

11. Wipe samples will be collected and tested according to EMD OPs FO.16. This will be a quantitative measure of radionuclide contamination.

12. All drill cuttings, soil samples, and water samples will be monitored for radionuclides and organic vapors in accordance with EMD OPs FO.15 and EMD OP FO.06. These procedures are described in the Health and Safety Plan, Integrated OUs (Jacobs 1993). Investigation-derived wastes, such as drill cuttings and residual samples, will be handled according to guidelines in EMD OPs FO.08 and FO.09.

13. The locations of all boreholes and sample points will be paced and/or taped off before sampling or drilling. After sampling or drilling, locations will be surveyed using standard land surveying techniques described in EMD OPs GT.17. Horizontal accuracy will be $\pm$ 0.5 foot for boreholes. Vertical accuracy will be $\pm$ 0.1 foot for boreholes.

14. All sampling activities will be documented in a field logbook and on forms. Documentation will include the following items listed in EMD OPs FO.13: sampling activity name and number, sampling point name and number, sample number, name(s) of collector(s) and others present, date and time of sample collection, sample container tag/label number (if appropriate), preservative(s), requested analyses, sample matrix, filtered or unfiltered, designation of quality control (QC) samples, collection methods, chain-of-custody control numbers, field observations and measurements during sampling, and signature.

Samples will be processed for shipment in accordance with EMD OPs FO.13, the chain-of-custody form will be completed, and a chain-of-custody number assigned to it.

15. The data tracking process will be in accordance with EMD OPs FO.14 using form FO.14A. The data entry process will be as prescribed on forms FO.14C, FO.14H, and FO.14K.

Approved By:

	Director	/ / *(Date)*
	Project Manager	/ / *(Date)*
TITLE: Operable Unit 9 Technical Memorandum No.1 Volume I, Part A	*Quality Assurance Program Manager*	/ / *(Date)*

5.0 SAMPLE ANALYSIS

Groundwater, soil, water, wipe, and surface soil samples will be analyzed for a specific set of parameters based on historical use, and waste streams contained in the tanks. This section summarizes the analytical parameters for all sampling.

Sample analyses for the tank investigation include TCL volatiles, TCL semivolatiles, PCBs, TAL metals, pesticides, herbicides, radionuclides, and water-quality parameters (including nitrate/nitrite, sulfate, chloride, fluoride, pH, specific conductance, and TOC). Wipe samples will be analyzed for gross alpha, and gross beta. Specific analytical parameters are shown in Table 5-1. Sample media and descriptions of the parameters for each sample were discussed in Section 3.2.

Sample containers and preservatives are shown in Table 5-2. QC samples are shown in Table 5-3.

TABLE 5-1
ANALYTICAL PARAMETERS
OU9 ORIGINAL PROCESS WASTE LINES

ANALYSIS	TANKS							
	T-1	T-2,T-3	T-7	T-10	T-14,T-15, T-16,T-17	T-21,T-22	T-27	T-29
CLP TAL for Metals	X	X	X	X	X	X	X	X
Chromium^{+6}	-	-	-	-	X	-	-	X
Tantalum	-	-	-	-	X	-	-	X
CLP Vol TCL	-	X	X	X	X	X	X	X
CLP SVol TCL	-	X	X	X	X	X	X	X
Polychlorinated biphenyls	-	X	X	-	-	-	-	-
Pesticides	-	-	X	-	-	-	-	-
Herbicides	-	-	X	-	-	-	-	-
WQPL	X	X	X	X	X	X	-	X
Total Organic Carbon	-	X	X	X	X	X	-	X
Uranium 233,234	X	X	X	X	X	X	X	X
Uranium 235	X	X	X	X	X	X	X	X
Uranium 238	X	X	X	X	X	X	X	X
Americium 241	X	X	X	X	X	X	X	X
Plutonium 239, 240	X	X	X	X	X	X	X	X
Tritium	-	-	-	X	X	-	-	-
Cesium 137	-	-	-	-	-	X	X	-

Notes:
CLP = Contract Laboratory Program
SVOL = Semivolatiles
TAL = Target Analyte List
TCL = Target Compound List
VOL = Volatiles
WQPL = Water Quality Parameter List (Nitrate/Nitrite, Sulfate, Chloride, pH, Specific Conductance)

NA = Not applicable
X = Analyte to be tested
- = Analyte will not be tested

All radionuclide analyses include gross alpha and gross beta.

TABLE 5-2
SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR RESIDUE, SOIL, AND WATER SAMPLES

PARAMETER	CONTAINER	PRESERVATION	HOLDING TIME
RESIDUE AND SOIL SAMPLES:			
TAL Metals (including Ta)	1 x 250 mℓ wide-mouth glass jar	Cool, 4°C	180 days[1]
Hexavalent Chromium	200 mℓ plastic or glass	Cool 4°C	24 hours
Cyanide	1 x 250 mℓ wide-mouth glass jar	Cool, 4°C	14 days
TCL Volatiles	2 x 125 mℓ wide-mouth glass teflon-lined jar	Cool, 4°C	7 days
Polychlorinated biphenyls	1 x 4 ℓ amber glass bottle	Cool, 4°C	7 days until extraction, 40 days after extraction
Organophosphorus Pesticides and Herbicides	1 x 4 ℓ amber glass bottle	Cool, 4°C	7 days until extraction, 40 days after extraction
TCL Semivolatiles	1 x 250 mℓ wide-mouth teflon-lined jar	Cool, 4°C	7 days until extraction, 40 days after extraction
Radionuclides	1 x 1 ℓ wide-mouth glass jar	None	180 days
WATER SAMPLES:			
TAL Metals (including Ta)	1 x 1 ℓ polyethylene bottle	Nitric acid pH<2; Cool, 4°C	180 days[1]
Cyanide	1 x 1ℓ polyethylene bottle	Sodium hydroxide pH >12; Cool, 4°C	14 days
TCL Volatiles	2 x 40 mℓ VOA vials with teflon-lined septum lids	Cool, 4°C	7 days
TCL Semivolatiles/ Polychlorinated Biphenyls	1 x 4 ℓ amber glass bottle	Cool, 4°C	7 days until extraction, 40 days after extraction
Radionuclides	4 ℓ polyethylene bottle(s)	Nitric acid pH <2; Cool, 4°C	180 days
Organophosphorus Pesticides and Herbicides	1 x 4 ℓ amber glass bottle	Cool, 4°C	7 days until extraction, 40 days after extraction
TOC	1 x 250 mℓ polyethylene bottle	Sulfuric acid pH <2; Cool, 4°C	28 days
Anions	1 x 1 ℓ polyethylene bottle	Cool, 4°C	28 days
Nitrate/Nitrite	1 x 250 mℓ polyethylene bottle	Sulfuric acid pH <2; Cool, 4°C	28 days
pH, temperature, and specific conductance	In situ, beaker or bucket	None	Analyze immediately

Notes:
[1] Holding Time for mercury is 28 days
C = Celsius
mℓ = milliliter
TAL = Target Analyte List
TCL = Target Compound List
ℓ = liters
Ta = Tantalum
TOC = Total Organic Carbon
VOA = Volatile Organic Analysis

TABLE 5-3
FIELD QC SAMPLE FREQUENCY
OU9 ORIGINAL PROCESS WASTE LINES

SAMPLE TYPE	TYPE OF ANALYSIS	SAMPLE FREQUENCY	
		SOLIDS	LIQUIDS
Duplicates	Organics	1/10	1/10
	Inorganics	1/10	1/10
	Radionuclides	1/10	1/10
Field Blanks	Organics	N/R	N/R
	Inorganics	1/20	1/20
	Radionuclides	1/20	1/20
Equipment Blanks*	Organics	1/20	1/20
	Inorganics	1/20	1/20
	Radionuclides	1/20	1/20
Trip Blanks	Organics	1/20	1/20
	Inorganics	N/A	N/A
	Radionuclides	N/A	N/A

Notes:
N/A = Not Applicable
N/R = Not Required
1/10 = one quality control (QC) sample per ten samples collected
* Frequency is 1/20 or once per day whichever is more frequent

Approved By:

Director	/ / *(Date)*
Project Manager	/ / *(Date)*
Quality Assurance Program Manager	/ / *(Date)*

TITLE:
Operable Unit 9
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6.0 REFERENCES

Jacobs Engineering Group Inc. 1993. *Health and Safety Plan, Accident Prevention Safety Program Plan Rocky Flats Plant Integrated Operable Units 8, 9, 10, 12, 13, and 14.* Phase I RFI/RI.

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U.S. Department of Energy. 1991 (January 22). *Federal Facility Agreement and Consent Order (Inter-Agency Agreement [IAG]: DOE, EPA, and CDH).* Washington, DC.

U.S. Department of Energy. 1992a (February). *Final Phase I RFI/RI Work Plan.* Rocky Flats Plant Original Process Waste Lines (Operable Unit 9).

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APPENDIX A

INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-1
MEDICAL BUILDING PROCESS WASTE

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
No Required Action	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. Investigation of removed tanks will consist of a single borehole drilled as closely as possible to the center of the original tank location. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of the original tank; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact).	1. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 4-foot grids and will cover the entire area of T-1 to delineate source. 2. Conduct a prework radiation survey of the borehole location to assess radioactive contamination. Survey will be conducted using the NaI instrument. 3. One borehole will be drilled as near to the center of the original tank location as possible. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One discrete soil sample will be collected at each of the following locations: a) 1 to 3 feet below the base of the original tank and b) directly above the water table or bedrock/alluvium contact, whichever is encountered first. 4. If groundwater is encountered during borehole drilling, a HydroPunch® will be used to collect groundwater samples according to GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-2, T-3 (IHSS 122)
UNDERGROUND CONCRETE TANKS AND ABOVE-GRADE STEEL TANKS

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE 1
1. Locate and describe all underground tanks associated with site 122, including the specific waste streams handled by these tanks. 2. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of site 122. The survey will be conducted using 10-foot grids and will cover the entire area of site 122. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. If the affected soils are covered with surfacing, 2-inch surface scrapes will be collected before constructing the boreholes required for this site. 3. Conduct a soil sampling survey after locating the underground tanks. Four boreholes will be placed around each tank associated with site 122 and will be drilled to a depth of 10 feet below the bottom of each tank or 3 feet into weathered bedrock, whichever is deeper. The soil samples will be composited to define each 2-foot interval and will be analyzed for HSL volatiles and nitrates. The soil samples will also be composited to represent 6-foot intervals. The 2-inch surface scrapes and 6 foot composites will be analyzed for total uranium, total plutonium, gross alpha, and gross beta.	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected from each tank. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends the bedrock/alluvium contact).	1. Conduct a visual tank inspection. 2. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, NaI radiation survey will be conducted. The survey shall be conducted using 4-foot grids and will cover the entire area of T-2 and T-3 to delineate source. 3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument and in accordance with OP FO.16, Field Radiological Measurements. 4. Two residue samples will be collected from the above grade tank and associated piping. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. One water sample will be collected from each of the three concrete vaults. In instances where no water is present, one wipe sample will be collected from the interior surface of the vaults. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 5. Five grab surface soil samples will be collected from discrete locations under above-grade tank and piping connections where leaks may have occurred. Six composite surface soil samples will be collected around the tanks. Soil samples will be collected according to OP GT.08, Surface Soil Sampling. Five boreholes will be drilled, one on each accessible side of the tanks. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method.

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-2, T-3 (IHSS 122)
UNDERGROUND CONCRETE TANKS AND ABOVE-GRADE STEEL TANKS

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE 1
		In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks. If the base of the tank is in bedrock or if the water table is not encountered and the distance from the base of the tank to the alluvium/bedrock contact is less than 5 feet, this sample will be omitted; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) 1 foot below the bedrock/alluvium contact or at refusal if bedrock is encountered before the water table. 6. If groundwater is encountered during borehole drilling, a HydroPunch® sampler will be used to collect groundwater samples, according to OP GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit
SOP = Standard Operating Procedure

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-7 (IHSS 159)
RADIOACTIVE SITE - BLDG. 559

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
1. Submit the report(s) documenting the radiometric survey conducted from 1975 to 1983 and any cleanup activities for this site. 2. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of the areas affected by site 159. The survey will be conducted using 10-foot grids and will cover all the areas affected by site 159. If "hotspots" are detected, the grid must be tightened to locate the source of radiation. 3. Conduct a soil sampling survey of the soils affected by site 159 using cores drilled to a depth of 5 feet below the invert of the waste line(s) or 3 feet into weathered bedrock, whichever is deeper. Borehole core samples will also be composited to represent 2 feet of soil. The 2-foot composites shall be analyzed for HSL volatiles. Borehole core samples shall also be composited to represent six-foot intervals of soil. The 2-inch surface scrapes and the 6-foot composites shall be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, and HSL metals. Two-inch surface scrapes will be sampled before constructing all boreholes and where surfacing exists to prevent the radiation survey.	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One boreholes will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact).	1. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 4-foot grids and will cover the entire area of T-7 to delineate source. 2. Conduct a prework radiation survey of the borehole location to assess radioactive contamination. Survey will be conducted using the NaI instrument, and in accordance with OP FO.16, Field Radiological Measurements. 3. Four boreholes will be drilled; one on each accessible side of the tank vault. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, the boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks. If the base of the tank is in bedrock or if the water table is not encountered and the distance from the base of the tank to the alluvium/bedrock contact is less than 5 feet, this sample will be omitted; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) 1 foot below the bedrock/alluvium contact or at refusal if bedrock is encountered before the water table.

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-7 (IHSS 159)
RADIOACTIVE SITE - BLDG. 559

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE 1
		5. If groundwater is encountered during borehole drilling, a HydroPunch® will be used to collect groundwater samples according to OP GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OP = EMD Operating Procedure
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-10 (IHSS 132)
RADIOACTIVE SITE #4 - 700
UNDERGROUND PROCESS WASTE TANKS

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
1. Conduct a soil sampling survey of the areas affected by site 132. Soil boreholes will be placed around each tank associated with site 132 and will be drilled to a depth of 10 feet below the bottom of each tank or 3 feet into weathered bedrock, whichever is greater. The soil samples will be composited to define each 6-foot interval and will be analyzed for total americium, total beryllium, total uranium, total plutonium, total alpha, and total beta.	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected from each tank. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One boreholes will be drilled on each accessible side of the tank vault. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact).	1. Conduct a visual tank inspection. 2. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI survey will be conducted. The survey will be conducted using 4-foot grids and will cover the entire area of T-9 and T-10 to delineate source. 3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument, and in accordance with OP FO.16, Field Radiological Measurements. 4. One residue sample will be collected from each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 5. Four boreholes will be drilled; one on each accessible side of the tank vault. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks. If the base of the tank is in bedrock or if the water table is not encountered and the distance from the base of the tank to the alluvium/bedrock contact is less than 5 feet, this sample will be omitted;

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-10 (IHSS 132)
RADIOACTIVE SITE #4 - 700
UNDERGROUND PROCESS WASTE TANKS

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
		c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) 1 foot below the bedrock/alluvium contact or at refusal if bedrock is encountered before the water table. 6. If groundwater is encountered during borehole drilling, a HydroPunch® will be used to collect groundwater samples according to OP GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-14 (IHSS 124.1)
RADIOACTIVE LIQUID WASTE STORAGE TANK, RFP TANK 68

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
1. Close the regulated units in accordance with this agreement and the regulations (as required by Section I.B.11 of the SOW). 2. Submit Phase I and Phase II RFI/RI reports documenting investigations for each site in accordance with the schedules within Table 6 of the SOW. The Phase I and Phase II reports shall at a minimum contain information to characterize the nature, rate, and extent of contamination; define pathways and methods of migration; identify areas threatened by releases from the facility; and determine short- and long-term threats to human health and the environment. (Submit RFI/RI workplans in accordance with Section I.B.11 and Table 6 of the SOW. Submit the required reports and close the units in accordance with the schedules in Table 6 of the SOW.) 3) Submit all Phase I and Phase II Closure/Interim Measure/Interim Remedial Action reports as required by Section I.B.11 of the SOW, and in accordance with the schedule requirements within Table 6 of the SOW.	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Conduct residue sampling of each tank that has not been cleaned and painted since, removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank vault location. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact).	1. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey shall be conducted using 4-foot grids and will cover the entire area of T-14 to delineate source. 2. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument, and in accordance with OP FO.16, Field Radiological Measurements. 3. One residue sample will be collected from each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 4. Conduct a soil sampling survey of the areas affected by the tanks T-14. Three boreholes will be drilled on accessible sides of the tank vault. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. Since contaminated soil has been detected in this area, five soil samples from each borehole will be collected from the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; and b) one composite sample at each 2-foot interval to a depth of 10 feet below the base of the tanks or until the water table or bedrock is encountered. The water table at this location is estimated to be at 5 to 8 feet below ground surface. Therefore, it is estimated that samples will be collected from depths of 2, 4, 6 and 8 feet in each borehole.

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-14 (IHSS 124.1)
RADIOACTIVE LIQUID WASTE STORAGE TANK, RFP TANK 68

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
		5. If groundwater is encountered during borehole drilling, a HydroPunch® will be used to collect groundwater samples according to OP GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-16 (IHSSs 124.2, 124.3, 125)
HOLDING TANK, RFP TANKS 66 AND 67

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE 1
1. Submit the report(s) documenting the radiometric survey conducted from 1975 to 1983. 2. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of site 125. If the releases occurred after surfacing was in place, then the survey should be conducted without removing the surfacing. If the spills occurred before the surfacing was placed then the top 2 inches of the soil surface will be sampled and analyzed for radiation before drilling and boreholes. The survey shall be conducted using the 10-foot grids and will cover all areas affected by site 125. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. 3. Conduct a soil sampling survey of the areas affected by sites 125. Soil boreholes will be placed around each tank associated with site 125 and will be drilled to a depth of 10 feet below the bottom of each tank. The soil samples shall be composited to define each 2-foot interval and will be analyzed for HSL volatiles. In addition, the soils will be composited to represent 6-foot intervals and will be analyzed for nitrates, total americium, beryllium, total uranium, total plutonium, gross alpha, and gross beta. In addition to the soil bores, surface scrapes 2 inches deep will be taken at the soil borings and analyzed for the same constituents as required for the soil boring composites. At least two of the boreholes shall be completed as	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank vault. In all cases, boreholes will be drilled as close as possible to the tank vault structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock, for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first, c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact).	1. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey shall be conducted using 4-foot grids and will cover the entire area of T-16 to delineate source. 2. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument, and in accordance with OP FO.16, Field Radiological Measurements. 3. One residue sample will be collected from each tank which not been cleaned and painted since removal from process waste service, help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 4. Conduct a soil sampling survey of the areas affected by the tanks T-16. Two boreholes will be drilled on the downgradient side of the tank. The boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank vault structure. Since contaminated soil has been detected in this area, five soil samples from each borehole will be collected from the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) one composite sample at each 2-foot interval to a depth of 10 feet below the base of the tanks or until the water table or bedrock is encountered. The water table at this location is estimated to be at 5 to 8 feet below ground surface. Therefore, it is estimated that samples will be collected from depths of 2, 4, 6 and 8 feet in each borehole.

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-16 (IHSSs 124.2, 124.3, 125)
HOLDING TANK, RFP TANKS 66 AND 67

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
downgradient alluvial monitoring wells. The location and number of these wells shall be proposed in the RFI/RI workplan to be submitted in accordance with Section I.B.9 of the SOW. These wells shall be sampled immediately upon completion and quarterly thereafter. Groundwater samples shall be analyzed for total nitrate, HSL volatiles, gross alpha, gross beta, total plutonium, total uranium, tritium, and HSL metals.		5. If groundwater is encountered during borehole drilling, a HydroPunch® will be used to collect groundwater samples according to OP GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OPWL = Original Process Waste Lines
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-29
BUILDING 774 PROCESS WASTE TANK

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
1. Submit the report(s) documenting the radiometric survey conducted from 1975 to 1983. 2. Verify the location of these tanks. 3. Conduct a radiation survey using a G-M shielded pancake detector and sideshielded FIDLER of the areas affected by site 146. The survey shall be conducted using 10-foot grids and will cover all areas affected by site 146 including the road and ground surfaces affected by the overflow of these tanks. If concrete or asphalt surfacing exists over affected soils, the surface soils will be sampled before constructing the required boreholes. If "hotspots" are detected, the grid must be tightened to locate the source of the radiation. 4. Conduct a soil sampling survey of all areas affected by site 146 including the areas affected by tank overflow, using surface soil scrapings to a depth of 2 inches and soil cores composited to represent each 2 feet of soil. The boreholes will be drilled to a depth of 10 feet below the tank inverts or to below the bottom of the building, whichever is required to assess the contamination of the soils related to this site. The location of six boreholes will be proposed in the Work Plan after verifying the location of these tanks. For three of the six boreholes, the core samples will be composited to represent 2-foot intervals. These 2-foot composites will be analyzed for HSL volatiles and HSL semi-volatiles. For all six boreholes the soils will be	1. No boreholes are proposed for tanks that were located beneath production buildings.	1. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 4-foot grids and will cover the entire area of T-15 and T-17 to delineate source. 2. No soil sampling survey will be conducted for stage 1 activities. Locations of removed Tanks T-15 and T-17 are beneath the south wing of Building 774.

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANK T-29
BUILDING 774 PROCESS WASTE TANK

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
composited to represent 6-foot intervals. The borehole composites and surface scrapes will be analyzed for total plutonium, total americium, beryllium, total chromium, tritium, total nitrate, uranium 233/234, uranium 235, uranium 238, gross alpha, gross beta, total sodium, total sulfate, and HSL metals.		

Notes:

HPGe = high purity germanium
HSL = hazardous substance list
NaI = sodium iodide
OU = Operable Unit

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-21, T-22, T-27
BUILDING 886 UNDERGROUND PROCESS WASTE PIT AND PORTABLE LIQUID DUMPSTER

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
No Required Action	1. Conduct a prework radiation survey of borehole locations according to OP FO.16, Field Radiological Measurements. 2. Conduct residue sampling of each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. One sample will be collected. In instances where no residue is present, one wipe sample will be taken from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 3. Boreholes will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. One borehole will be drilled on each accessible side of the tank. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling) collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade tanks unless base of tank is in bedrock for above-grade or on-grade tanks, mid-depth between the ground surface and the water table or alluvium/bedrock interface, whichever is encountered first; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first, and d) in bedrock at the bedrock/alluvium contact if groundwater is not encountered above the contact (i.e., where the vadose zone extends to the bedrock/alluvium contact).	1. Conduct a visual tank inspection. 2. Conduct an HPGe survey of the area to assess radioactive contamination. If radioactive anomalies are found, a NaI radiation survey will be conducted. The survey will be conducted using 4-foot grids and will cover the entire area of T-21, T-22, and T-27 to delineate source. 3. Conduct a prework radiation survey of all sample locations to assess radioactive contamination. Survey will be conducted using the NaI instrument, and in accordance with OP FO.16, Field Radiological Measurements. 4. One residue sample will be collected from each tank that has not been cleaned and painted since removal from process waste service, to help characterize OPWL wastes. In instances where no residue is present, one wipe sample will be collected from the interior surface of the tank. Wipe samples will be collected and tested according to OP FO.16, Field Radiological Measurements. 5. One water sample will be collected from the concrete vault if water is present. 6. Four boreholes will be drilled; one on each side of the tanks. The borehole will be drilled and sampled according to OP GT.02, Drilling and Sampling Using Hollow-stem Auger Techniques, using the continuous core method. In all cases, boreholes will be drilled as close as possible to the tank structure. One discrete soil sample will be collected at each of the following locations: a) ground surface (before drilling), collected according to OP GT.08, Surface Soil Sampling; b) 1 to 3 feet below the base of below-grade

APPENDIX A
INVESTIGATION REQUIREMENTS AND PROPOSED ACTIONS
TANKS T-21, T-22, T-27
BUILDING 886 UNDERGROUND PROCESS WASTE PIT AND PORTABLE LIQUID DUMPSTER

INTER-AGENCY AGREEMENT REQUIRED ACTION	OU9 WORK PLAN REQUIRED ACTION	OU9 PROPOSED ACTION FOR STAGE I
		tanks. If the base of the tank is in bedrock or if the water table is not encountered and the distance from the base of the tank to the alluvium/bedrock contact is less than 5 feet, this sample will be omitted; c) directly above the water table or bedrock/alluvium contact, whichever is encountered first; and d) 1 foot below the bedrock/alluvium contact or at refusal if bedrock is encountered before the water table. 7. If groundwater is encountered during borehole drilling, a HydroPunch® will be used to collect groundwater samples according to OP GW.06, Groundwater Sampling.

Notes:
HPGe = high purity germanium
NaI = sodium iodide
OP = EMD Operating Procedure
OPWL = Original Process Waste Lines
OU = Operable Unit

APPENDIX B

DATA NEEDS AND DATA QUALITY OBJECTIVES (FROM OU9 WORK PLAN)

Approved By:

Work Plan Manager 6/9/92 (Date)

Division Manager 6/17/92 (Date)

Effective Date: 4/29/92

4.0 DATA NEEDS AND DATA QUALITY OBJECTIVES

The primary objective of an RFI/RI is collection of data necessary to determine the nature, distribution, and migration pathways of contaminants and to quantify any risks to human health and the environment. These assessments determine the need for remediation and are used to evaluate remedial alternatives, if necessary. The five general goals of an RFI/RI (EPA, 1988a) are as follows:

- Characterize site physical features
- Define contaminant sources
- Determine the nature and extent of contamination
- Describe contaminant fate and transport
- Provide a baseline risk assessment.

As stipulated in the IAG, RCRA regulated OUs have a two phase investigative approach. Phase I will characterize the contaminant sources and the soils within the OU. Phase II will determine the nature, extent, fate, and transport of any contamination.

Data quality objectives (DQOs) are qualitative and quantitative statements that specify the quality and quantity of data required to support the objectives of the RFI/RI (EPA, 1987a). The DQO process is divided into three stages:

- Stage 1 - Identify decision types
- Stage 2 - Identify data uses/needs
- Stage 3 - Design data collection program.

Through application of the DQO process, site-specific goals were established for the Phase I RFI/RI and data needs were identified for achieving those goals. This section proceeds through the DQO process specific to the Phase I RFI/RI for OU9.

4.1 STAGE 1 - IDENTIFY DECISION TYPES

Stage 1 of the DQO process is to identify decision makers, data users, and the types of decisions that will be made as part of the Phase I RFI/RI. The general decision types were identified early in Stage 1 to determine data types sufficient to support decisions.

4.1.1 Identify and Involve Data Users

Data users are divided into three groups: decision makers, primary data users, and secondary data users. The decision makers for OU9 are personnel from EG&G, DOE, EPA, and CDH who are responsible for decisions related to management, regulation, investigation, and remediation of OU9. The decision makers are involved through the review and approval process specified in the IAG. Primary data users are individuals involved in ongoing Phase I RFI/RI activities for OU9. These individuals are the technical staff of CDH, EPA, EG&G, and EG&G subcontractors, including geoscientists, statisticians, risk assessors, engineers, and health and safety personnel. They will be involved in collection and analysis of data and in preparation of the Phase I RFI/RI report, including the Baseline Human Health Risk Assessment and the Environmental Evaluation. Secondary data users are those users who rely on RFI/RI outputs to support their activities. Secondary data users of the Phase I RFI/RI information may include personnel from EPA, CDH, EG&G, and EG&G subcontractors working in areas such as data base management, quality assurance, records control, and laboratory management.

4.1.2 Evaluate Available Data

The historical and current conditions of OU9 are described in Section 2.2. Previous OPWL investigations are described in Section 2.4.3. No known effort has been made to validate the very limited amount of analytical data available regarding possible contamination associated with OU9. For the purposes of this Work Plan, it is assumed that no usable analytical data currently exists upon which further characterization of OU9 can be based. Additional data compilation activities identified in Section 7.2.4 may uncover additional data useful in directing the Phase I investigation. The adequacy of any data derived from these activities will be assessed to determine their useability in defining DQOs for OU9.

4.1.3 Develop Conceptual Model

A conceptual model for OU9 is developed in Section 2.5 and is illustrated in Figures 2-8 and 2-9. This model includes a description of the contaminant sources, release mechanisms, transport media, exposure routes, and receptors. Because no valid data are available, the model is strictly conceptual.

4.1.4 Specify Phase I RFI/RI Objectives and Data Needs

Based on the existing site information (Section 2.2), the nature of contamination (Section 2.4), the conceptual model for OU9 (Section 2.5), and the lack of useable existing data (Section 4.1.2), site-specific Phase I RFI/RI objectives and data needs associated with characterizing contaminant sources and the soils have been developed. These are summarized in Table 4.1.

In accordance with the IAG, the specific objective of the Phase I RFI/RI field investigation of OU9 is to characterize the contaminant sources and the soils. The extent of contamination in soils will be assessed to meet this objective.

4.2 STAGE 2 - IDENTIFY DATA USES/NEEDS

The data needed to meet each of the site-specific Phase I RFI/RI objectives developed for OU9 are listed in Table 4.1. The associated sampling and analysis activities are also identified in Table 4.1. Specific plans for obtaining the needed data are presented in Section 7.0 (Field Sampling Plan). The

following sections discuss the uses, general types, quality, and quantity of the data needed for the OU9 Phase I RFI/RI.

4.2.1 Identify Data Uses

RFI/CMS data can be categorized according to use for the following general purposes:

- Site characterization
- Health and safety
- Risk assessment
- Evaluation of alternatives
- Engineering design of alternatives
- Monitoring during remedial action
- Determination of potentially responsible parties (PRPs).

Because this Work Plan describes a Phase I RFI/RI, data uses such as engineering design and monitoring during remediation (both remedial action activities) will not be considered. The data use for PRP determination is also not appropriate to this Work Plan. The remaining four data uses will be important in meeting the objectives identified in Table 4.1. Data uses for specific sampling and analysis activities for the Phase I investigation at OU9 are listed in Table 4.1.

4.2.2 Identify Data Types

Data types can initially be divided into broad groups and again divided into more specific components. For the Phase I investigation, residue, soil, and wipe samples will be collected. These data types will provide Phase I information to characterize physical features and contamination at OU9. Selection of chemical analyses has been based on the objectives of the Phase I program and on the past activities at OU9. Data types are listed in Table 4.1.

4.2.3 Identify Data Quality Needs

EPA defines five levels of analytical data (EPA, 1987a):

- Level I - Field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real time. It is the least costly of the analytical options.
- Level II - Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a portable laboratory on-site. There is a wide range in the quality of the data that can be generated. The quality depends on the use of suitable calibration standards, reference materials, and sample preparation equipment and on the training of the operator. Results are available in real time or several hours.
- Level III - All analysis performed in an off-site laboratory. Level III analyses may or may not be performed according to CLP procedures, but the validation or documentation procedures required of CLP Level IV analysis are not usually utilized. The laboratory may or may not be a CLP laboratory.
- Level IV - CLP routine analytical services (RAS). All analyses are performed in an off-site CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.
- Level V - Analysis by non-standard methods. All analyses are performed in an off-site analytical laboratory that may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

Analytical data levels I, II, IV, and V will be necessary for performing Phase I field activities. The levels appropriate to the data needs and data uses have been specified in Table 4.1.

Data quality for the Phase I RFI/RI will be achieved by meeting the requirements for Level I through V data outlined in GRRASP (EG&G, 1991e) and by adhering to the data collection protocols provided in agency-approved OPs and Document Change Notices (DCNs).

4.2.4 Identify Data Quantity Needs

Data quantity needs are based primarily on an evaluation of the information available for characterizing the site physical features and contamination at OU9. This is consistent with guidance

provided in Data Quality Objectives for Remedial Response Activities (EPA, 1987a) and Guidance for Data Useability in Risk Assessments (EPA, 1990a). The rationale for sampling quantities is described in the FSP presented in Section 7.0.

4.2.5 Evaluate Sampling/Analysis Options

To ensure that sufficient and adequate data are collected, the Phase I RFI/RI for OU9 is based on a staged approach where initial sampling activities are used to identify areas requiring additional investigation. OPWL structural features, historical release reports, field observations, and conceptual model release scenarios will be used to identify primary sampling locations. Analytical results from these sampling activities will be used to identify areas of contamination requiring further investigation. These areas will be further sampled to provide an assessment of the extent of contamination in soils.

Two types of activities will be performed during the Phase I field investigation: (1) field screening activities, and (2) sampling activities. Screening activities (Levels I and II) include visual inspection and radiological surveys. Sampling activities (Levels IV and V) include analysis of surficial soils, subsurface materials from test pits and soil borings, and residue from pipelines and tanks.

Sampling options for the Phase I RFI/RI were selected on the basis of their ability to provide adequate data to characterize the contaminant sources and the soil. The lack of available data for OU9 mandates a comprehensive sampling program to ensure that adequate source characterization is achieved. However, the large expanse of OU9 dictates that the sampling program be properly focused to collect only those samples required to achieve source characterization. The staged sampling approach provides a logical means of obtaining a thorough characterization while minimizing the number of samples required.

Analytical options were selected to obtain data meeting the DQOs and the Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters discussed below.

4.2.6 Review of PARCC Parameter Information

PARCC parameters are indicators of data quality. Precision, accuracy, and completeness goals are established for this Work Plan according to the analyses being performed and the analytical levels. PARCC goals are specified in the QAA discussed in Section 10.0.

The analytical program requirements for OU9 are discussed in Section 7.2.2. GRRASP (EG&G, 1991e) provides a listing of the CLP analytes and detection/quantification limits for Target Compound List (TCL) volatile organics, TCL semivolatile organics, Target Analyte List (TAL) metals, radionuclides, and inorganic parameters. These analytical methods are appropriate for meeting the data quality requirements for analytical Levels I through V during the Phase I RFI/RI. The precision, accuracy, and completeness parameters for analytical Levels I through V are discussed below, along with the completeness and representativeness for all analytical levels.

Precision measures the reproducibility of measurements under a given set of conditions. Accuracy measures the bias or source of error in a group of measurements. Precision and accuracy objectives for the analytical data collected for the Phase I RFI/RI at OU9 will be evaluated according to the control limits specified in the referenced analytical method and/or in data validation guidelines. For the radionuclide analyses, the accuracy objectives specified in GRRASP will be followed. The specified criteria for precision and accuracy are described in the QAA. Precision and accuracy for non-analytical data will be achieved through protocols outlined in agency-approved OPs and DCNs.

Completeness is defined as the percentage of measurements made that are judged to be valid. The target completeness objective for the OU9 field and analytical data is 100 percent, although 90 percent will be the minimum acceptable level. Again, to ensure that a sufficient amount of valid data are generated, the FSP was designed to include a staged sampling approach. These components of the FSP are discussed further in Section 7.0.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. In order to achieve comparability, work will be performed at OU9 in

accordance with approved sampling and analysis plans, standard analytical protocols, and approved OPs for data collection. Consistent units of measurement will be used for data reporting.

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a particular site or condition. Representativeness is a qualitative parameter related to the design of the sampling and analysis components of the investigative program. The FSP described in Section 7.0 and the referenced OPs describe the rationale for the sampling program to provide for representative samples.

4.3 STAGE 3 - DESIGN DATA COLLECTION PROGRAM

The purpose of Stage 3 of the DQO process is to design the specific data collection program for the Phase I RFI/RI for OU9. To accomplish this, the elements identified in the FSP were assembled and the SAP was prepared. The SAP consists of (1) a Quality Assurance Project Plan (QAPjP) that describes the policy, organization, functional activities, and QA/QC protocols necessary to achieve the DQOs dictated by the intended use of the data and (2) an FSP that provides guidance for all fieldwork by defining in detail the sampling and data collection methods to be used in the Phase I RFI/RI for OU9. These two components are presented in Sections 7.0 and 10.0, respectively. A detailed discussion of all samples to be obtained is presented in Section 7.0 for each media and includes sample type, rationale for sample frequency and location.

TABLE 4.1

PHASE I RFI/RI DATA QUALITY OBJECTIVES AT OU 9

OBJECTIVE (DATA NEED)	DATA TYPE	SAMPLING/ANALYSIS ACTIVITY	ANALYTICAL LEVEL	DATA USE
CHARACTERIZE SITE PHYSICAL FEATURES AND HISTORICAL OPERATIONS				
Historical release information, waste stream characterization, as-built information, and operational information	Release reports, waste stream analyses, personnel interviews, engineering drawings	Compile and review additional data	N/A	Focus field investigation activities Focus sample analytical parameters

TABLE 4.1

PHASE I RFI/RI DATA QUALITY OBJECTIVES AT OU 9
(Continued)

OBJECTIVE (DATA NEED)	DATA TYPE	SAMPLING/ANALYSIS ACTIVITY	ANALYTICAL LEVEL	DATA USE
CHARACTERIZE NATURE OF CONTAMINATION IN SOURCES				
Identify pipeline release locations	Data from surface radiation surveys	Perform surface radiation surveys at locations where surface soils were impacted by pipeline releases	II	Site Characterization Baseline Risk Assessment Environmental Evaluation Evaluation of Remedial Alternatives
	Field observation of pipelines and surrounding soil	Observe pipeline condition in test pits excavated at documented release locations, structural features, and/or locations based on observations from previous test pits and pipeline release conceptual model	N/A	
	Data from pipeline pressure testing	Perform pressure testing of pipeline sections between test pits	II	
Identify and characterize contaminant sources in OPWL pipelines	Data from radiation screening of pipelines	Measure dose rates inside pipeline openings in test pits using field radiological instruments	I	
	Data from residue and wipe samples	Collect residue samples from pipelines in test pits; analyze for TAL Metals, TOC, TCL Volatiles, TCL Semivolatiles, Radionuclides, Anions, pH, and specific conductance	IV (V for radionuclides)	
		Collect wipe samples from pipelines with no residue; analyze for qualitative radionuclides	II	

TABLE 4.1

PHASE I RFI/RI DATA QUALITY OBJECTIVES AT OU 9
(Continued)

OBJECTIVE (DATA NEED)	DATA TYPE	SAMPLING/ANALYSIS ACTIVITY	ANALYTICAL LEVEL	DATA USE
Identify tank release locations	Data from surface radiation surveys	Perform surface radiation surveys at locations where surface soils were impacted by tank releases	II	Site Characterization Baseline Risk Assessment Environmental Evaluation Evaluation of Remedial Alternatives
	Field observation of tanks	Observe condition of tank interiors through tank openings	N/A	
Identify and characterize contaminant sources in OPWL tanks	Data from radiation screening of tanks	Measure does rates inside tanks using field radiological instruments	I	
	Data from residue and wipe samples	Collect residue samples from tanks; analyze for TAL Metals, TOC, TCL Volatiles, TCL Semivolatiles, Radionuclides, Anions, pH, and specific conductance	IV (V for radionuclides)	
		Collect wipe samples from tanks with no residue; analyze for qualitative radionuclides	II	

TABLE 4.1

PHASE I RFI/RI DATA QUALITY OBJECTIVES AT OU 9
(Continued)

OBJECTIVE (DATA NEED)	DATA TYPE	SAMPLING/ANALYSIS ACTIVITY	ANALYTICAL LEVEL	DATA USE
CHARACTERIZE NATURE AND EXTENT OF CONTAMINATION IN SOILS				
Characterize soil contamination at pipeline release sites	Data from soil samples	Stage 1 - Collect samples of surface soil, trench backfill, and native soil from test pits; analyze for TAL Metals, TOC, TCL Volatiles, TCL Semivolatiles, Radionuclides, Anions, pH, and specific conductance	IV (V for radionuclides)	Site Characterization Baseline Risk Assessment Environmental Evaluation Evaluation of Remedial Alternatives
Characterize soil contamination along pipeline alignments	Data from soil samples	Stage 2 - Collect samples of surface soil, trench backfill, and native soil from soil borings located along pipeline alignments around contaminated test pits; analyze for analytes of concern identified by results of Stage 1 sampling		

TABLE 4.1

PHASE I RFI/RI DATA QUALITY OBJECTIVES AT OU 9
(Continued)

OBJECTIVE (DATA NEED)	DATA TYPE	SAMPLING/ANALYSIS ACTIVITY	ANALYTICAL LEVEL	DATA USE
Assess extent of soil contamination at pipeline release locations	Data from soil samples	Stage 3 - Collect samples of surface soil, trench backfill, and native soil from soil borings located within and surrounding contaminated areas identified through Stage 1 and Stage 2 sampling; analyze for analytes of concern identified by results of Stage 1 and Stage 2 sampling	IV (V for radionuclides)	Site Characterization Baseline Risk Assessment Environmental Evaluation Evaluation of Remedial Alternatives
Characterize soil contamination around OPWL tanks	Data from soil samples	Stage 1 - Collect samples of surface and subsurface soil from soil boring placed on each accessible side of tank; analyze for TAL Metals, TOC, TCL Volatiles, TCL Semivolatiles, Radionuclides, Anions, pH, and specific conductance		
Assess extent of soil contamination around OPWL tanks	Data from soil samples	Stage 2 - Collect samples of surface and subsurface soils from soil borings placed around contaminated tank locations; analyze for analytes of concern identified by results of Stage 1 sampling		

APPENDIX C

QUALITY ASSURANCE ADDENDUM (FROM OU9 WORK PLAN)

Approved By:

Work Plan Manager — 6/9/92 (Date)

Division Manager — 6/17/92 (Date)

Effective Date: 4/29/92

10.0 QUALITY ASSURANCE ADDENDUM

This section consists of the Quality Assurance Addendum (QAA) for Phase I investigations at Operable Unit No. 9 (OU9), which supplements the "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA Remedial Investigation/Feasibility Studies and RCRA Facility Investigations/Corrective Measures Studies Activities" (QAPjP). This QAA establishes the site-specific Quality Assurance (QA) controls applicable to the investigation activities described in the OU9 Work Plan (OU9 WP).

OU9 is one of 16 OUs identified for investigations under the IAG. OU9 consists of the OPWL, the various components of which are considered IHSS 121. IHSS 121 currently consists of 35,000 feet of underground pipelines and 65 tanks. The area addressed by the OU9 Phase I RFI/RI includes areas in close proximity to the OPWL pipelines and tanks, and areas from which OPWL pipelines and tanks have been removed. The physical setting of OU9 is described in Section 2.0 and illustrated in Figure 2-1.

The OU9 Phase I of the RFI/RI process involves characterization of the contaminant sources and the soils within the OU. This includes sampling residue in tanks and pipelines and sampling of soils, which the OU9 WP has interpreted to include vadose zone (unsaturated) surficial deposits. The OU9 WP has been prepared in accordance with the Federal and State of Colorado regulations and guidance documents identified in the Introduction (Section 1.0).

10.1 ORGANIZATION AND RESPONSIBILITIES

The overall organization of EG&G, the EMD, and divisions involved in ER Program activities is shown in Figures 1-1, 1-2, and 1-3 of Section 1.0 of the QAPjP. Individual responsibilities are also described in Section 1.0 of the QAPjP.

Contractors will be tasked by EG&G to implement the field activities outlined in the OU9 WP. The specific EMD personnel who will interface with the Contractors and who will provide technical direction are shown in Figure 10-1.

10.2 QUALITY ASSURANCE PROGRAM

The QAPjP was written to address QA controls and requirements for implementing IAG-related activities. The content of the QAPjP was driven by Department of Energy (DOE) RFP Standard Operating Procedure (OP) 5700.6B, which requires a QA program to be implemented for all RFP activities. This program is required to be developed based on American Society of Mechanical Engineers (ASME) NQA-1, "Quality Assurance Requirements for Nuclear Facilities," as well as the IAG, which specifies that a QAPjP for IAG-related activities be developed in accordance with the EPA QAMS-005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans." The 18-element format of NQA-1 was selected as the basis for both the QAPjP and subsequent SAAs with the applicable elements of QAMS-005/80 incorporated where appropriate. Figure 2-1 of the QAPjP illustrates where the 16 QA elements of QAMS-005/80 are integrated into the QAPjP and also into this QAA. Section 2.0 of the QAPjP also identifies other DOE Orders and QA requirements documents to which the QAPjP and this QAA are responsive.

The controls and requirements addressed in the QAPjP are applicable to OU9 Phase I RFI/RI activities, unless specified otherwise in this QAA. Where site-wide actions are applicable to OU9 activities, the applicable section of the QAPjP is referenced in this QAA. This QAA addresses additional and site-specific QA controls and requirements that are applicable to OU9 Phase I activities that may not have been addressed on a site-wide basis in the QAPjP. Many of the QA requirements specific to OU9 are addressed in the OU9 WP and are referenced in this QAA.

10.2.1 Training

Personnel qualification and training requirements for RFP ER Program activities are addressed in Section 2.0 of the QAPjP. Personnel qualifications and training required to perform the EMD OPs that are applicable to OU9 investigations are specified within the respective procedures. The EMD OPs (which are also referred to as OPs in the QAPjP and the OU9 WP) are identified in Table 10.1.

10.2.2 Quality Assurance Reports to Management

A QA summary report will be prepared annually or at the conclusion of these activities (whichever is more frequent) by the EMD Quality Assurance Project Manager (QAPM) or designee. This report will include a summary of field operation and laboratory inspections, surveillance, and audits and a report on data verification/validation results.

10.3 DESIGN CONTROL AND CONTROL OF SCIENTIFIC INVESTIGATIONS

10.3.1 Design Control

Section 7 describes the Phase I investigation activities that will be implemented to characterize the physical features of the site and define the contaminant sources at OU9. A summary of Phase I RFI/RI activities to be conducted at OU9 is presented in Table 7.2. Section 9 describes the EE activities to be conducted to characterize the biotic environment and address and quantify the ecological effects from exposure to contaminants within OU9. The OU9 WP identifies the objectives of the investigations; specifies the sampling, analysis, and data generation requirements; and identifies applicable operating procedures that will provide controls for the investigations. As such, the OU9 WP is considered the investigation control plan for OU9 Phase I RFI/RI activities.

10.3.2 Data Quality Objectives

Data needs and DQOs for OU9 Phase I investigations are addressed in Section 4.0, and Section 9.2.1 for the EE data. The DQOs for the OU9 Phase I investigations were established in accordance with EPA guidance for developing DQOs, which is summarized in Appendix A of the QAPjP.

The specific objectives, or data needs, of the OU9 Phase I RFI/RI are based on existing site information regarding the nature of contamination present and the preliminary site-specific conceptual model for OU9. These specific objectives determine the type of data to be collected. The quality of the data is dependent on the analytical level of the data, which dictates the type of sampling and analytical or measurement quality controls that should be adhered to in generating the data. The EPA has defined five levels of analytical data (Levels I - IV). These analytical levels are defined in Section 4.0 and Appendix A of the QAPjP. Level I or II analytical or measurement data requires less QC than does Level II - V quantitative analytical data, which is of a known quality.

The intended use of the data determines which analytical level is required for the RFI/RI data to be generated. The type of data that needs to be generated and the analytical level of the data together determine the sampling and analytical or measurement options to be employed to generate measurement data appropriate for its intended use. The data needs, data types, sampling and analysis activities, analytical levels, and data use for the OU9 Phase I RFI/RI are identified in Table 4.1.

Data quality can be measured in terms of PARCC parameters. These parameters are defined in Appendix A of the QAPjP. PARCC parameter goals are established prior to initiating investigations in order to assist decision makers in determining if DQOs for measurement data have been met.

PARCC parameter goals for measurement data are established so that they are appropriate to the analytical level of the data. Analytical Level IV and V data require analysis of environmental samples by EPA approved methods and adherence to QC requirements that are specified by the EPA CLP. Historical precision and accuracy measures for EPA CLP analytical and equivalent methods have been determined. These historical measures have been selected as the precision and accuracy goals for all OU9 analytical IV and V data. These historical precision and accuracy measures for soil materials are listed in Appendix B of the QAPjP. These same goals are also applicable to the analysis of materials collected from pipelines and tanks. If any material from pipelines and tanks consist of a liquid matrix, the precision and accuracy goals for water samples are applicable.

Accuracy goals for field parameters (i.e., wipe samples from OPWL pipelines and tanks) to be measured during Phase I investigations (analytical Level II data, which consists of field analysis or measurements using portable equipment) consist of adhering to approved operating procedures for sampling and analysis, including following applicable instrument calibration requirements.

Goals for representativeness, comparability, and completeness for the OU9 Phase I RFI/RI are specified in Section 4.2.6.

The ecological characterization activities described in Section 9.0 are considered screening activities that, typically, require Analytical Level I and II data. These characterization data will then be used, along with the OU9 RFI/RI characterization and source contamination data, to develop the conceptual model for the EE study. Data quality for these characterization activities will be controlled by adhering to the field sampling operating procedures for EEs listed in Table 1 and implementing the EE Field Sampling Plan (Section 9.3).

The conceptual model developed for the OU9 ecosystem will then assist investigators in identifying site-specific target species, contaminants of concern, and potential exposure pathways. Additional DQOs for the contamination assessment tasks (Tasks 4 through 7 of Section 9) and the ecotoxicological studies (Task 8) will then be developed following steps recommended by the EPA in EPA/600/3-89/013, Ecological Assessments of Hazardous Waste Sites: A Field Guide and Laboratory Reference Document, and EPA/540/G-90/008, Guidance for Data Usability in Risk Assessment. The ecosystem characterization data and preliminary aquatic toxicity investigation data that will be obtained by implementing the EE Field Sampling Plan are needed to develop these additional DQOs.

10.3.3 Sampling Locations and Sampling Procedures

The sampling rationale for the OU9 Phase I RFI/RI is based on an interactive process. Stage 1 sampling is designed to detect points of contamination in OU9 soils using the release scenarios developed in the conceptual model presented in Section 2.5. Stage 2 sampling activities are designed

to provide a preliminary assessment of the extent of contamination present in OU9. Locations of contamination identified by analytical results from Stage 1 will be investigated further by sampling on a grid pattern to delineate the contaminant plume.

The field sampling design, including sampling locations, frequencies, methods, and procedures are described in Section 7.3. Sampling locations, frequencies, and procedures for the EE program, consisting of vegetation, small mammals, and arthropods sampling are addressed in Section 9.3.

The operating procedures that are applicable to OU9 Phase I field activities and the particular activities to which they are applicable are summarized in Table 10.1.

10.3.4 Analytical Procedures

The analytical program for the OU9 Phase I RFI/RI is discussed in Section 7.4. The analyses of soil and residue samples collected from Stage 1 sampling is specified in Section 7.4.1 and listed in Table 7.2. Wipe samples from pipelines and tanks will be screened in the field for radionuclide contamination according to OP-FO.16, Field Radiological Measurements, which will provide a qualitative measure of radionuclide contamination. The analytical methods and specified detection/quantitation limits for the analysis of Stage 1 samples are specified in Appendix B of the QAPjP. Analytes of interest for Stage 2 sampling will be based on results of Stage 1 samples.

10.3.5 Equipment Decontamination

Non-dedicated sampling equipment (i.e., sampling equipment that is used at more than one location) shall be decontaminated between sampling locations in accordance with OP-FO.03, General Equipment Decontamination. Other equipment (e.g., heavy equipment) potentially contaminated during drilling, hydrogeologic/geologic testing, boring, sample collection, etc., shall also be decontaminated as specified in OP-FO-04, Heavy Equipment Decontamination.

10.3.6 Air Quality

Air monitoring will be conducted during implementation of field activities that have the potential to create windblown dispersion of contaminants, including drilling, coring, and installation of monitoring wells. Air monitoring will ensure that OU9 RFI/RI activities comply with the RFP Interim Plan for Prevention of Contamination Dispersion. Air monitoring will be conducted according to OP-FO.01, Wind Blown Contaminant Dispersion Control.

10.3.7 Quality Control

To ensure the quality of the field sampling techniques, collection and/or preparation of field quality control (QC) samples are incorporated into the sampling scheme. Field QC samples and collection frequencies for OU9 are addressed in Section 7.6 and identified in Table 7.5. A specific sampling schedule will be prepared by the sampling subcontractor for approval by the EG&G Laboratory Analysis Task Leader (Figure 10-1) prior to sampling.

10.3.7.1 Objectives for Field QC Samples

Equipment rinsate blanks are considered acceptable (with no need for data qualification) if the concentration of analytes of interest is less than three times the required detection limit for each analyte as specified in Table 7.1. Field duplicate samples shall agree within 30 percent relative percent difference for aqueous samples and 40 percent for homogenous, non-aqueous samples.

Trip blanks and field preservation blanks (for organics and inorganics, respectively) indicate possible field contamination when analytes are detected above the minimum detection limits presented in Table 7.1. The Laboratory Analysis Task Leader (Figure 10-1) is responsible for verifying these criteria and shall be responsible for checking to see if they are met and for qualifying data.

10.3.7.2 Laboratory Quality Control

Laboratory QC procedures are used to provide measures of internal consistency of analytical and storage procedures. The laboratory contractor will submit written OPs to the Laboratory Analysis Task Leader for approval. The inter-laboratory OPs shall be consistent with or equivalent to EPA-

CLP QC procedures. The laboratory OPs must cover the following areas in sufficient detail and reflect actual operating conditions in effect during analysis of EG&G samples:

- Sample receipt and log-in
- Sample storage and security
- Facility security
- Sample tracking (from receipt to sample disposition)
- Sample analysis method references
- Data reduction, verification, and reporting
- Document control (including submitting documents to EG&G)
- Data package assembly (see Section III.A of the GRRASP)
- Qualifications of personnel
- Preparation of standards
- Equipment maintenance and calibration
- List of instrumentation and equipment (including date purchased, date installed, model number, manufacturer, and service contracts, if any)
- Instrument detection limits
- Acceptance criteria for non-CLP analyses
- Laboratory QC checks applicable to each analytical method.

Laboratory QC techniques to ensure consistency and validity of analytical results (including detecting potential laboratory contamination of samples) include using reagent blanks, field blanks, internal standard reference materials, laboratory replicate analysis, and field duplicates. The laboratory contractor will follow the standard evaluation guidelines and QC procedures, including frequency of QC checks, that are applicable to the particular type of analytical method being used as specified in Parts A and B of the GRRASP and Section 3.0 of the QAPjP. All data packages will be forwarded

to the Laboratory Analysis Task Leader or validation contractor (Figure 10-1) for review and verification.

10.3.8 Quality Assurance Monitoring

To assure the overall quality of the RFI/RI activities discussed in the OU9 WP, field inspections will be conducted daily and audits and surveillance will be conducted at various intervals. The intervals will be determined by the importance and complexity of each activity. Intervals will also be based on the schedule contained in Section 6.0. At a minimum, each of the field sampling activities described in Sections 7.3 and 9.3 will be monitored by an independent surveillance team at least once during the sampling process. EG&G will conduct audits of the laboratory contractor(s) as specified in the GRRASP, Parts A and B. The audits and surveillance, and activity Readiness Reviews are discussed further in Section 10.18.

10.3.9 Data Reduction, Validation, and Reporting

10.3.9.1 Analytical Reporting Turnaround Times

Analytical reporting turnaround times are as specified in Table 3-1 of Section 3.0 of the QAPjP.

10.3.9.2 Data Reduction

Reduction of laboratory measurements shall be in accordance with the procedures specified for each analytical method. Laboratory data will be compiled into sample data packages by the laboratory contractor. A sample data package shall be developed for each sample delivery group or sample batch, with separate data packages for each type of analysis (e.g., a data package for organics, one for inorganics, one for water quality parameters, and one for radionuclides). The sample data package shall consist of a cover sheet/transmittal letter, a case narrative, data summary forms, and copies of the data checklists found in Attachment I in Parts A and B of the GRRASP. The reduced data will be used in the data validation process to verify that the laboratory control and overall system DQOs have been met.

10.3.9.3 Data Validation

Validation activities consist of reviewing and verifying field and laboratory data and evaluating these verified data for data quality (i.e., comparison of reduced data to DQOs, where appropriate). The field and laboratory data validation activities and guidelines are described and referenced in Section 3.0 of the QAPjP. The process for validating the quality of the data is illustrated graphically in Figure 3-1 of Section 3.0 of the QAPjP, and is also included as part of the sample collection, chain-of-custody, and analysis process illustrated in Figure 8-1 of Section 8.0 of the QAPjP. The criteria for determining the validity of ER Program data at Rocky Flats are described in subsection 3.3.7 of Section 3.0 of the QAPjP.

10.3.9.4 Data Management and Reporting

Data management and reporting requirements are specified in Section 7.5.

10.4 PROCUREMENT DOCUMENT CONTROL

Procurement documents for items and services, including services for conducting field investigations and analytical laboratories, shall be prepared, handled, and controlled in accordance with the requirements and methods specified in Section 4.0 of the QAPjP.

10.5 INSTRUCTIONS, PROCEDURES, AND DRAWINGS

The OU9 WP describes the activities to be performed. The OU9 WP will be reviewed and approved in accordance with the requirements for instructions, procedures, and drawings outlined in Section 5.0 of the QAPjP.

EMD OPs approved for use are identified in Table 10.1, which also indicates their applicability. Any additional quality-affecting procedures proposed for use but not identified in Table 10.1 will be developed and approved as required by Section 5.0 of the QAPjP prior to performing the affected activity.

Changes and variances to approved operating procedures and the OU9 WP shall be documented through preparation of Document Change Notices (DCNs), which will be prepared, reviewed, and approved in accordance with requirements specified in Section 5.0 of the QAPjP. (Note: DCNs were referred to as Procedure Change Notices in Revision 0 of the QAPjP.)

10.6 DOCUMENT CONTROL

The following documents will be controlled in accordance with Section 6.0 of the QAPjP:

- "Phase I RFI/RI Work Plan for Rocky Flats Plant Original Process Waste Lines (Operable Unit No. 9)"
- "Rocky Flats Plant Site-Wide Quality Assurance Project Plan for CERCLA Remedial Investigation/Feasibility Studies and RCRA Facility Investigations/Corrective Measures Studies Activities" (QAPjP)
- EMD Operating Procedures (all operating procedures specified in the QAPjP, this QAA, and to-be-developed laboratory OPs).

10.7 CONTROL OF PURCHASED ITEMS AND SERVICES

Contractors that provide services to support the OU9 WP activities will be selected and evaluated as outlined in Section 7.0 of the QAPjP. This includes preaward evaluation/audit of proposed contractors as well as periodic audit of the acceptability of contractor performance during the life of the contract. Any items or materials that are purchased for use during the OU9 investigations that have the ability to affect the quality of the data shall be inspected upon receipt.

10.8 IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA

10.8.1 Sample Containers/Preservation

Appropriate volumes, containers, preservation requirements, and holding times for soil and residue samples are presented in Table 7.4. Requirements for EE samples collected for tissue analyses are included in Table 10.2.

10.8.2 Sample Identification

RFI/RI samples shall be labeled and identified in accordance with Section 8.0 of the QAPjP and OP-FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples. Samples shall have unique identification that traces the sample to the source(s) and indicates the method(s), date, the sampler(s), and conditions prevailing at the time of sampling.

10.8.3 Chain-of-Custody

Sample chain-of-custody will be maintained through the application of OPS-FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples, and as illustrated in Figure 8-1 of the QAPjP for all environmental samples collected during field investigations.

10.9 CONTROL OF PROCESSES

The overall process of collecting samples, performing analysis, and inputting the data into a database is considered a process that requires control. The process is controlled through a series of written procedures that govern and document the work activities. A process diagram is shown in Section 8.0 of the QAPjP.

10.10 INSPECTION

Procured materials and construction activities (e.g., groundwater monitoring well installation) shall be inspected (as applicable) in accordance with the requirements specified in Section 10.0 of the QAPjP.

10.11 TEST CONTROL

Test control requirements specified in Section 11.0 of the QAPjP are not applicable to any of the RFI/RI investigations described in the OU9 WP.

10.12 CONTROL OF MEASURING AND TEST EQUIPMENT (M&TE)

10.12.1 Field Equipment

Field measurements for radiation will be made with the following instrument:

- Radiological field readings for pipe and tank swipes and drill cuttings, core, and samples: A side-shielded field instrument for detection of low energy radiation (FIDLER), Ludlum Model 12-1A or equivalent.

Each piece of field equipment shall have a file that contains:

- Specific model and instrument serial number
- Operating instructions
- Routine preventative maintenance procedures, including a list of critical spare parts to be provided or available in the field
- Calibration methods, frequency, and description of the calibration solutions
- Standardization procedures (traceability to nationally recognized standards).

10.12.2 Laboratory Equipment

Laboratory analyses will be performed by contracted laboratories. The equipment used to analyze environmental samples shall be calibrated, maintained, and controlled in accordance with the requirements contained in the specific analytical protocols used as specified in Parts A and B of the GRRASP. This information will be supplied to EG&G as a laboratory OP.

10.13 HANDLING, STORAGE, AND SHIPPING

Samples shall be packaged, transported, and stored in accordance with OP-FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples. Maximum sample holding times, sample preservative, sample volumes, and sample containers are specified in table 8-1 of Section 8.0 of the QAPjP. Sample handling and storage controls at the laboratory shall be provided as a laboratory OP.

10.14 STATUS OF INSPECTION, TEST, AND OPERATIONS

The requirements for the identification of inspection, test, and operating status shall be implemented as specified in Section 14.0 of the QAPjP. A log specifying the status of all boreholes shall be maintained by the Field Activities Task Leader, which will include borehole identification number,

ground elevation, casing depth of hole, depth to bedrock, static water level (as applicable), diameter of hole, diameter of casing, and top/bottom of casing.

10.15 CONTROL OF NON-CONFORMANCES

The requirements for identification, control, evaluation, and disposition of nonconforming items, samples, and data will be implemented as specified in Section 15.0 of the QAPjP. Non-conformances identified by the implementing contractor shall be submitted to EG&G for processing as outlined in the QAPjP.

10.16 CORRECTIVE ACTION

The requirements for the identification, documentation, and verification of corrective actions for conditions adverse to quality will be implemented as outlined in Section 16.0 of the QAPjP. Conditions adverse to quality identified by the implementing contractor shall be documented and submitted to EG&G for processing as outlined in the QAPjP.

10.17 QUALITY ASSURANCE RECORDS

QA records will be controlled in accordance with OP-FO.02, Field Document Control. QA records to be generated during OU9 RFI/RI Phase I activities include, but are not limited to:

- Results of data compilation from review of existing information
- Record of tactical assessment
- Records of interviews and record searches.
- Field Logs and Data Record Forms (e.g., sample collection notebooks/logs for water, sediment, and air)
- Calibration Records
- Sample Collection and Chain-of-Custody Records
- Laboratory Sample Data Packages
- Drilling Logs

- Work Plan/Field Sampling Plan/QAA
- QAPjP
- Audit/Surveillance/Inspection Reports
- Nonconformance Reports
- Corrective Action Documentation
- Data Validation Results
- Data Reports
- Procurement/Contracting Documentation
- Training/Qualification Records
- Inspection Records.

10.18 QUALITY VERIFICATION

The requirements for the verification of quality shall be implemented as specified in Section 18 or the QAPjP. EG&G will conduct audits of the laboratory contractor as specified in the GRRASP, Parts A and B. The EMD QAPM shall develop a surveillance schedule with the surveillance intervals based on the importance and complexity of each sampling/analytical activity. Intervals will also be based on the schedule contained in Section 6.0.

Examples of some specific tasks that will be monitored by the surveillance program are as follows:

- Bore holes (approximately 10 percent of the holes)
- Field sampling (approximately 5 percent of each type of sample collected)
- Records management (a surveillance will be conducted once at the initiation of OU9 activities, and monthly thereafter)
- Data verification, validation, and reporting.

Audits of contractors providing field investigation, construction, and analytical support services shall be performed at least annually or once during the life of the project, whichever is more frequent.

A Readiness Review shall be conducted by the EMD QAPM prior to the implementation of OU9 field investigation activities. The readiness review will determine if all activity prerequisites have been met that are required to begin work. The applicable requirements of the QAPjP and this QAA will be addressed.

10.19 SOFTWARE CONTROL

The requirements for the control of software shall be implemented as specified in Section 19.0 of the QAPjP. Only database software is anticipated to be used for the OU9 WP activities. Operating procedures applicable to the use of the database storing environmental data can be found in OP-FO.14, Field Data Management.

TABLE 10.1
EMD Operating Procedures and Field Activities for Which They are Applicable

Former SOP Reference Number	EMD OPS Reference Number	Operating Procedures	Headspace Sampling	Subsurface Soil Sampling	Surface Soil Sampling	Biota Sampling
1.1	F0.01	Wind Blown Contaminant Dispersion Control		●		
1.2	F0.02	Field Document Control	●	●	●	●
1.3	F0.03	General Equipment Decontamination	●	●	●	●
1.4	F0.04	Heavy Equipment Decontamination		●		●
1.5	F0.05	Handling of Purge and Development Water		●		
1.6	F0.06	Handling of Personal Protective Equipment	●	●	●	●
1.7	F0.07	Handling of Decontamination Water & Wash Water	●	●	●	●
1.8	F0.08	Handling of Drilling Fluids & Cuttings		●		
1.9	F0.09	Handling of Residual Samples	●		●	●
1.10	F0.10	Receiving, Labeling, and Handling Waste Containers		●		●
1.11	F0.11	Field Communications	●	●	●	●
1.12	F0.12	Decontamination Facility Operations	●	●	●	●
1.13	F0.13	Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples	●	●	●	●
1.14	F0.14	Field Data Management	●	●	●	●
1.15	F0.15	Use of PIDs and FIDs	X	X	X	X
1.16	F0.16	Field Radiological Measurements	●	X	X	X
New	F0.18	Environmental Sample Radioactivity Content Screening	●	●	●	
New	F0.21	Protection of Threatened and Endangered and Special Concern Species				●

X - As required by H&S plan.

TABLE 10.1 (Continued)
EMD Operating Procedures and Field Activities for Which They are Applicable

Former SOP Reference Number	EMD OPS Reference Number	Operating Procedures	Residue Sampling	Subsurface Soil Sampling	Surface Soil Sampling	Biota Sampling	Sample
3.1	GT.01	Logging Alluvial and Bedrock Material		●			
3.2	GT.02	Drilling and Sampling Using Hollow-Stem Auger Techniques		●			
3.3	GT.03	Isolating Bedrock from the Alluvium with Surface Casing					
3.4	GT.04	Rotary Drilling and Rock Coring					
3.5	GT.05	Plugging and Abandonment of Boreholes		●			
3.6	GT.06	Monitoring Well and Piezometer Installation					
3.7	GT.07	Logging and Sampling of Test Pits and Trenches		●			
3.8	GT.08	Surface Soil Sampling			●		
3.10	GT.10	Borehole Clearing					
New	GT.17	Land Surveying			●		
New	TBD	Residue Sampling in Pipelines and Tanks	●				
5.8	EE.08	Sampling of Small Mammals				●	
5.9	EE.09	Sampling of Terrestrial Arthropods				●	
5.10	EE.10	Sampling of Terrestrial Vegetation				●	
5.11	EE.11	Identification of Habitat Types				●	
5.12	EE.12	Sampling of Soil for Soil Description				●	
5.13	EE.13	Development of Field Sampling Plans				●	

TABLE 10.2

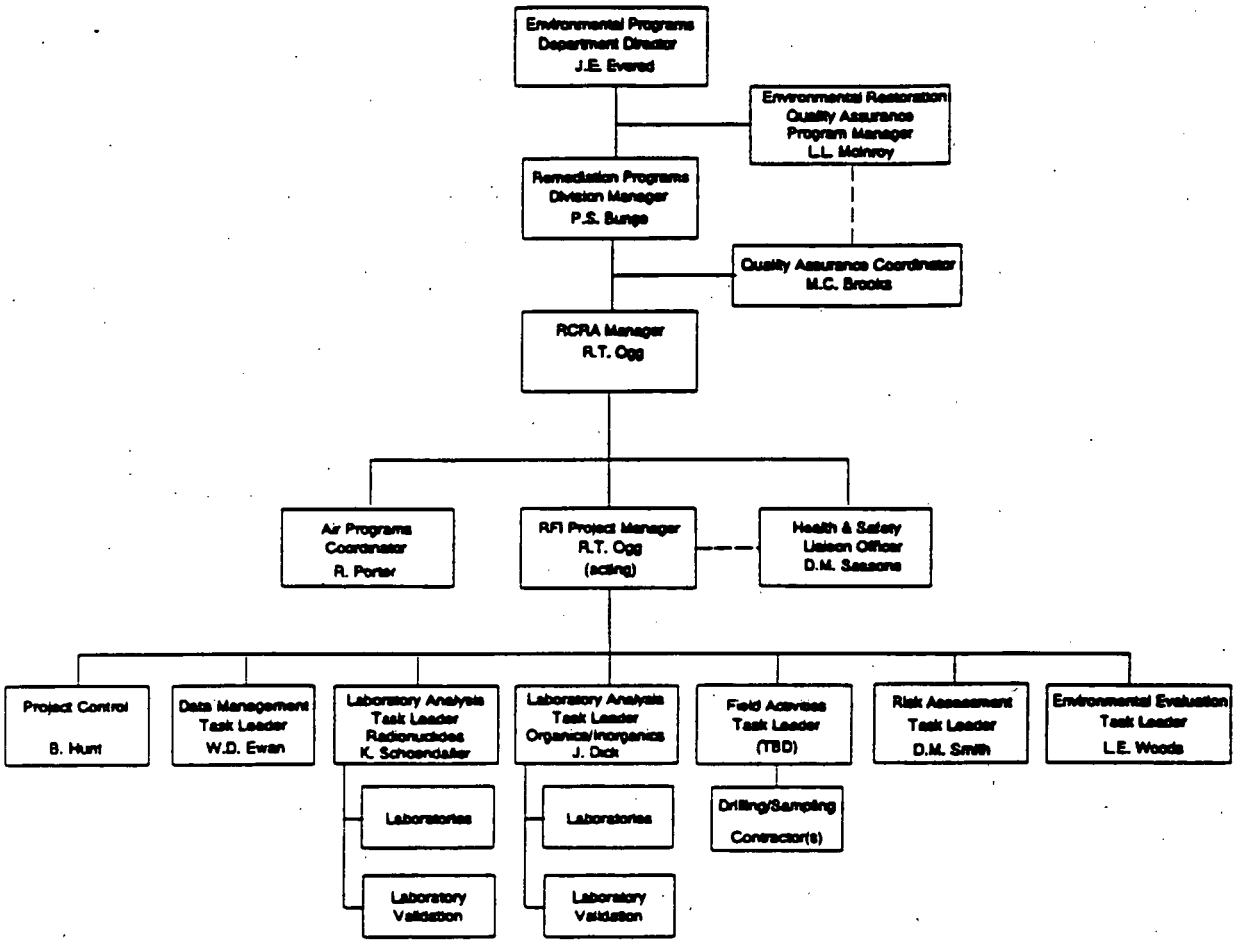
HOLDING TIMES, PRESERVATION METHODS, AND SAMPLE CONTAINERS FOR BIOTA SAMPLES

	Holding Time from Date Collected	Preservation Method	Container	Approximate Sample Size[1]
Samples for Metals Analyses Terrestrial Vegetation				
Metals determined by ICP[2]	6 months	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
Metals determined by GFAA[3]	6 months	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
Hexavalent chromium	24 hours	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	25 g
Mercury	28 days	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	5 g
Samples for Radionuclide Analyses Terrestrial Vegetation				
Uranium 223, 234, 235, 238 Americium 241 Plutonium 239, 240	6 months	Freeze & ship w/dry ice	Paper bag inserted into plastic bag and sealed	1 kg

[1] Sample size may vary with specific laboratory requirements.
[2] ICP = Inductively Coupled Argon Plasma Emission Spectroscopy. Metals to be determined include Ba, Cr, Cu, and Fe.
[3] GFAA = Graphite Furnace Atomic Absorption Spectroscopy. Metals to be determined include As, Cd, Li, Pb, Se, and Sr.

FIGURE 10-1

PROJECT MANAGEMENT FOR OPERABLE UNIT 9, ORIGINAL PROCESS WASTE LINES, PHASE I RFI/RI



APPENDIX D

DETAILED ENGINEERING DRAWINGS OF TANKS FOR RESIDUE SAMPLING

TANK ACCESS FOR RESIDUAL, PRODUCT, AND WATER SAMPLING

T-1 NA (Removed)

T-2 Tank 2 consists of a 3,000-gallon underground concrete tank and three valve vaults. The 3,000-gallon underground tank is abandoned, and no samples will be collected from it. The three valve vaults will have water samples collected from them, if water is present. Access into the valve vaults is through manways.

T-3 Tank 3 consists of one 3,200-gallon aboveground steel tank and one 3,000-gallon underground concrete tank. One residue or product sample will be collected from the aboveground steel tank. The sample point will be from pipe entrance into tank on the top side of the tank or by dismantling the piping on the south side of the tank, depending on whether product is in tank. No sample will be collected from the underground concrete tank.

T-7 Tank 7 consists of two 2,000-gallon steel tanks and a sump located in an underground vault. These tanks and sump are presently being deactivated. No residual sampling will be performed.

T-9, T10 Tanks 9 and 10 are located beneath Building 730. Tank 9 consists of two 22,550-gallon underground concrete tanks. These tanks have been taken out of service, cleaned and painted, and converted to plenum deluge tanks. These tanks will not be sampled for residue. Tank T-10 consists of two 4,500-gallon underground concrete tanks. These tanks have been abandoned but not cleaned and painted. Residue or product samples will be collected from each of the T-10 tanks. Access points for sampling will be the pump piping that can be dismantled for sampling.

T14, T16 Tank T-14 consists of one 30,000-gallon underground concrete tank. One residue or product sample will be collected from this tank. Sample access point will be the manway. T-16 consists of two 14,000-gallon underground concrete tanks. One residue or product sample will be collected from each tank. According to Plant personnel, the manways to the tanks were sealed until decommissioning and decontamination activities. If tanks cannot be accessed by the manways, the tank piping system can be dismantled for sampling. The piping system is located in the piping tunnel adjacent to the tanks.

T-15, T-17 N/A (Removed)

T-21, T-22, T-27 Tanks 21 and 22 are located in Building 828. Tank 21 is a 250-gallon concrete floor sump, and T-22 consists of two 250-gallon steel tanks located in a concrete vault. If water is present in the tank vaults, water samples will be collected from each. Residue or product samples will be collected from each tank and the floor sump. Sample access points for the tanks will be the piping matrix. Piping will be T-22 dismantled for sampling. Sample point for the sump is the concrete surface. The two 250-gallon tanks are located in different concrete vaults. One tank can be accessed through Building 828. The other tank can only be accessed by lifting off the concrete covers. To avoid breaking the seal of the concrete lid, the sample point for this tank will be the piping located on the northeast corner of the tank vault.

T-27 N/A (Removed)

T-29 Tank T-29 is a 200,000-gallon on-grade steel tank. One water sample will be collected from the valve vault north of Tank T-29 if water is present. Two residual samples will be collected from T-29: one sample from the overflow pipe on the east side and one sample from the manway on the west side.

APPENDIX E

TANK SOIL SAMPLING LOCATIONS (FROM OU9 WORK PLAN)

APPENDIX F

ANALYTICAL DATA FOR TANK T-27

ANALYTICAL REPORT

ROCKWELL INTERNATIONAL
ROCKY FLATS PLANT
P.O. BOX 464
GOLDEN, COLORADO 80402

GENERAL LABORATORY
BUILDING 881

DISTRIBUTION:

R. W. Hawes, Env. Mgmt. 250
R. E. Rothe, Crit. Mass. 886
W. I. Yamada, Pu Rec. Proc. 130

File

LAB NUMBER: E89-1730

DATE: 10-9-89
ACCOUNT NO: 986122-A3

APPROVED: Georgia Campbell
G. K. Campbell

SAMPLE DESCRIPTION

Sample Description: Soil Samples (886 tank leak) #1, #2, #3. Analysis Required: Uranium isotopics, nitrate (colorimetric) and pH

ANALYSIS RESULTS

Soil Samples Location

Refer to the attached diagram for the specific location where soil samples were taken.

Uranium Isotopics

An aliquot of each soil sample was weighed as received, weighed after drying in an oven at approximately 100 degrees centigrade to determine the percent moisture content and weighed again after drying in a muffle furnace at approximately 600 degrees centigrade to determine moisture and volatiles content. Each soil was then prepared for uranium isotopic analysis according to the laboratory's procedure and analyzed by alpha spectrometry. The following results are given as activity in pCi per gram of dried and muffled sample weight and are isotopically consistent with natural occurring uranium, where the U235 alpha activity is approximately 2 percent of the U238 and U234 sum.

pCi/gram dried

	U238	U235	U234
Soil #1	0.88 ± 0.10	0.04 ± 0.01	1.2 ± 0.1
Soil #2	0.87 ± 0.10	0.03 ± 0.01	0.80 ± 0.10
Soil #3	0.97 ± 0.11	0.04 ± 0.01	1.0 ± 0.1

pCi/gram muffled

	U238	U235	U234
Soil #1	0.89 ± 0.10	0.04 ± 0.01	1.2 ± 0.1
Soil #2	0.88 ± 0.10	0.03 ± 0.01	0.81 ± 0.10
Soil #3	0.98 ± 0.12	0.04 ± 0.01	1.0 ± 0.1

ANALYTICAL REPORT E89-1730 Date: 10-9-89

	% moisture loss after drying at 100° C	% moisture + volatiles loss after muffling at 600° C
Soil #1	1.53	2.62
Soil #2	1.50	2.42
Soil #3	3.87	5.12

The quality assurance data associated with the isotopic analyses were acceptable and are on file in the General Laboratory.

The laboratory has a National Institute of Science and Technology (formerly National Bureau of Standards) Rocky Flats Soil Standard Reference Material (SRM) 4353 which was collected at Rocky Flats and certified for U238 and U234. However, it is not known where at the Rocky Flats Plant the samples for the reference material were taken, or if the SRM is representative. Certified values are as follows:

Activity Concentration (air-dried and pulverized RF soil)

	Bq/g	Pci/g
U238	0.0389	1.05
U234	0.0391	1.06

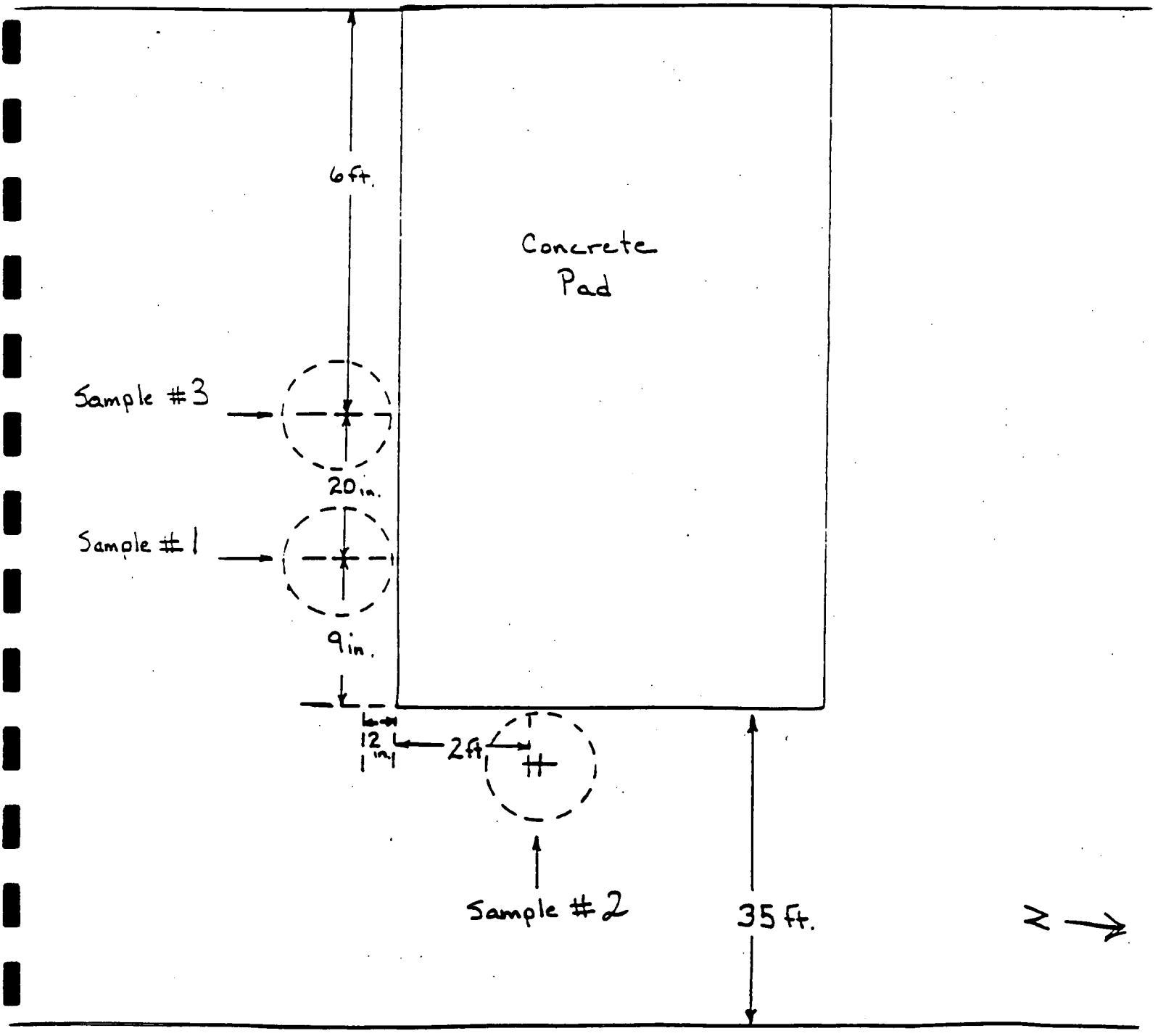
Using the assumption that for natural uranium, the U235 alpha activity is 2 percent of the U238 and U234 sum, the U235 activity for SRM 4353 Rocky Flats soil can be estimated as 0.04 pCi/g. Comparing these values with the three soil samples listed above, it appears that the soils are isotopically similar for uranium to the SRM 4353 RF soil. Again, it is not known if these activity levels are typical for the Rocky Flats area and surrounding areas. Background soil isotopic information is available on plantsite, possibly from S.A. Anderson of Waste Compliance, G.L. Potter in H.S.&E. or from the Environmental Restoration group on plantsite.

Nitrate (colorimetric) and pH

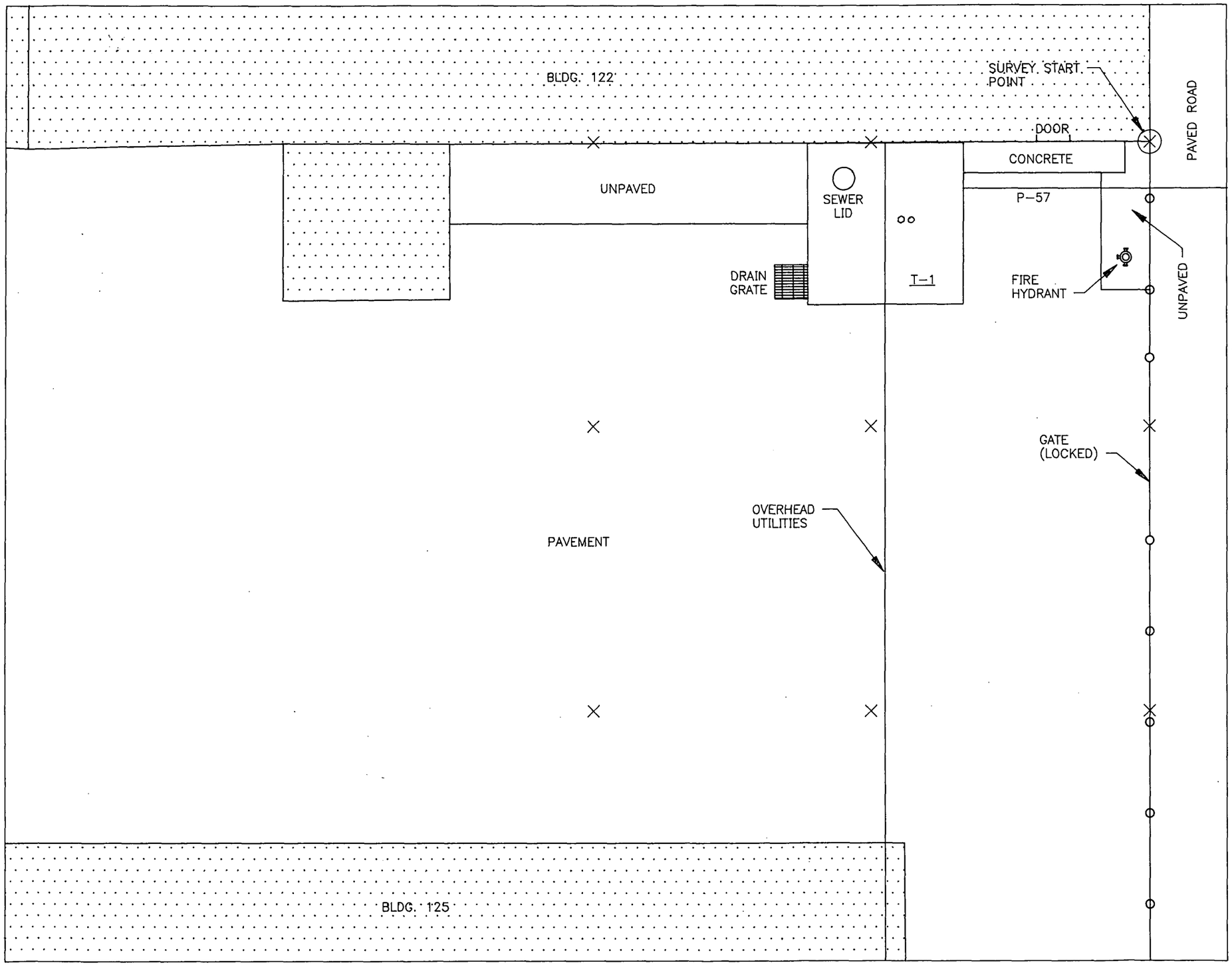
	Nitrate (mg/kg)	pH
Soil #1	10	6.6
Soil #2	8	6.9
Soil #3	8	7.2

E89-1730
9-27-89

898
Guard
Post



886 Bldg. F-3



U.S. Department of Energy

Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

ACTIVITY	NUMBER
Borehole	1
Hydropunch	1
HPGe	9

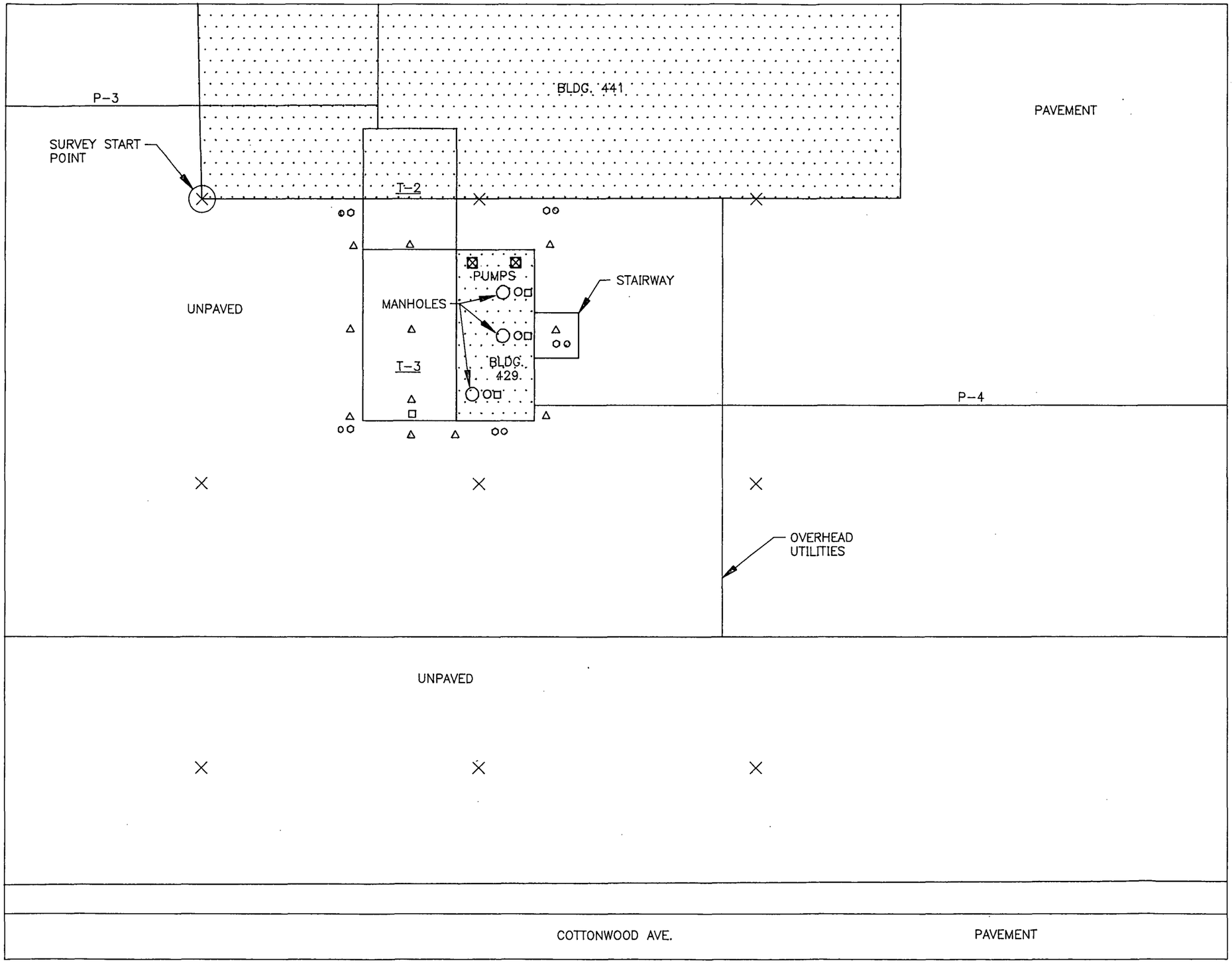
-N-

FIGURE 3-1
SAMPLE LOCATIONS
FOR T-1
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"

C:\RFLATS\TC\T-1.DWG



U.S. Department of Energy
Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

ACTIVITY	NUMBER
Borehole	5
Surface Soil (RFP)	6
Surface Soil (Grab)	5
Residual	4
Water	3
Hydropunch	5
HPGe	9

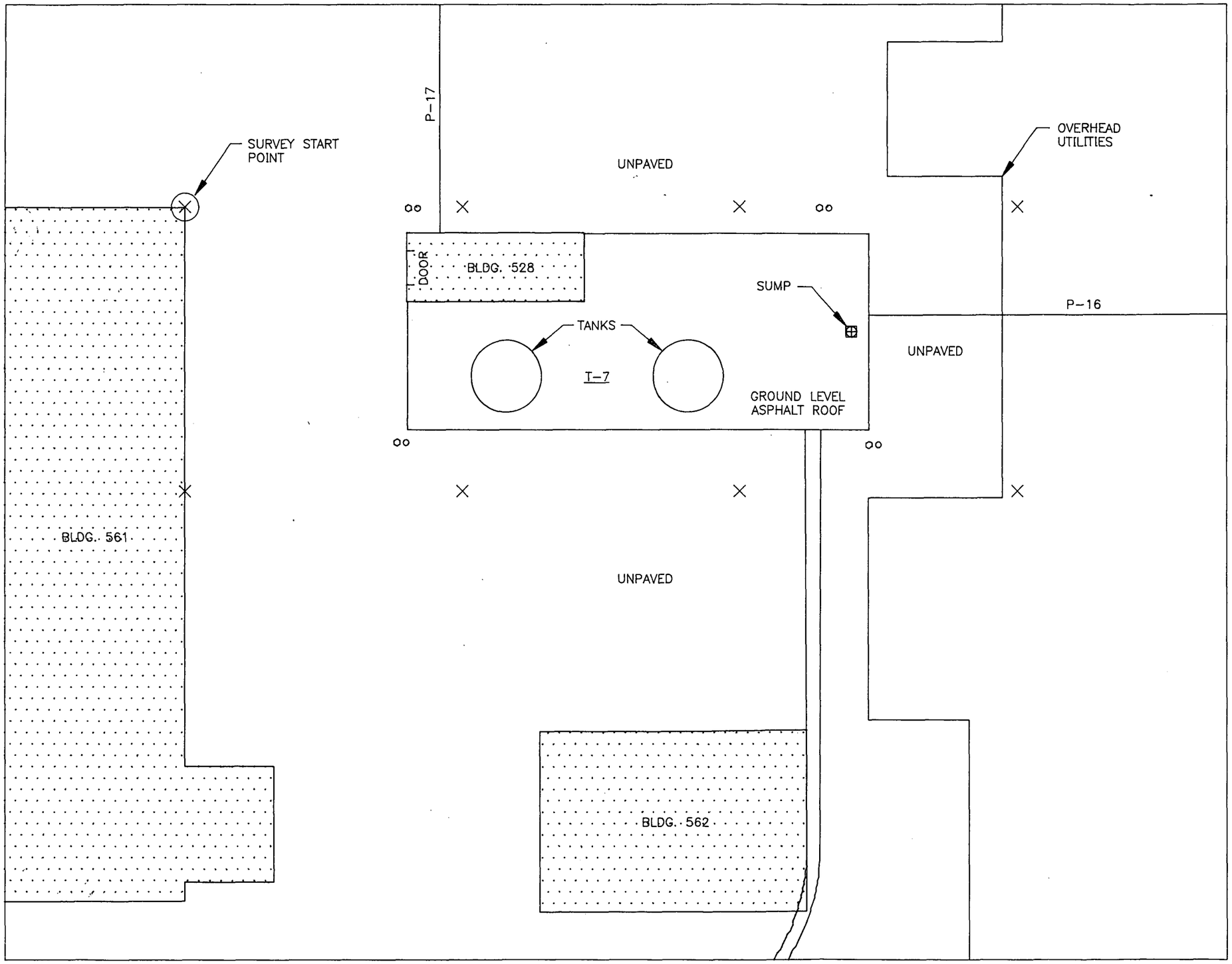
-N-

FIGURE 3-2
SAMPLE LOCATIONS
FOR T-2 AND T-3
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"

C:\RLATS\TC\T-2_3.DWG



U.S. Department of Energy
Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

ACTIVITY	NUMBER
Borehole	4
Hydropunch	4
HPGe	8

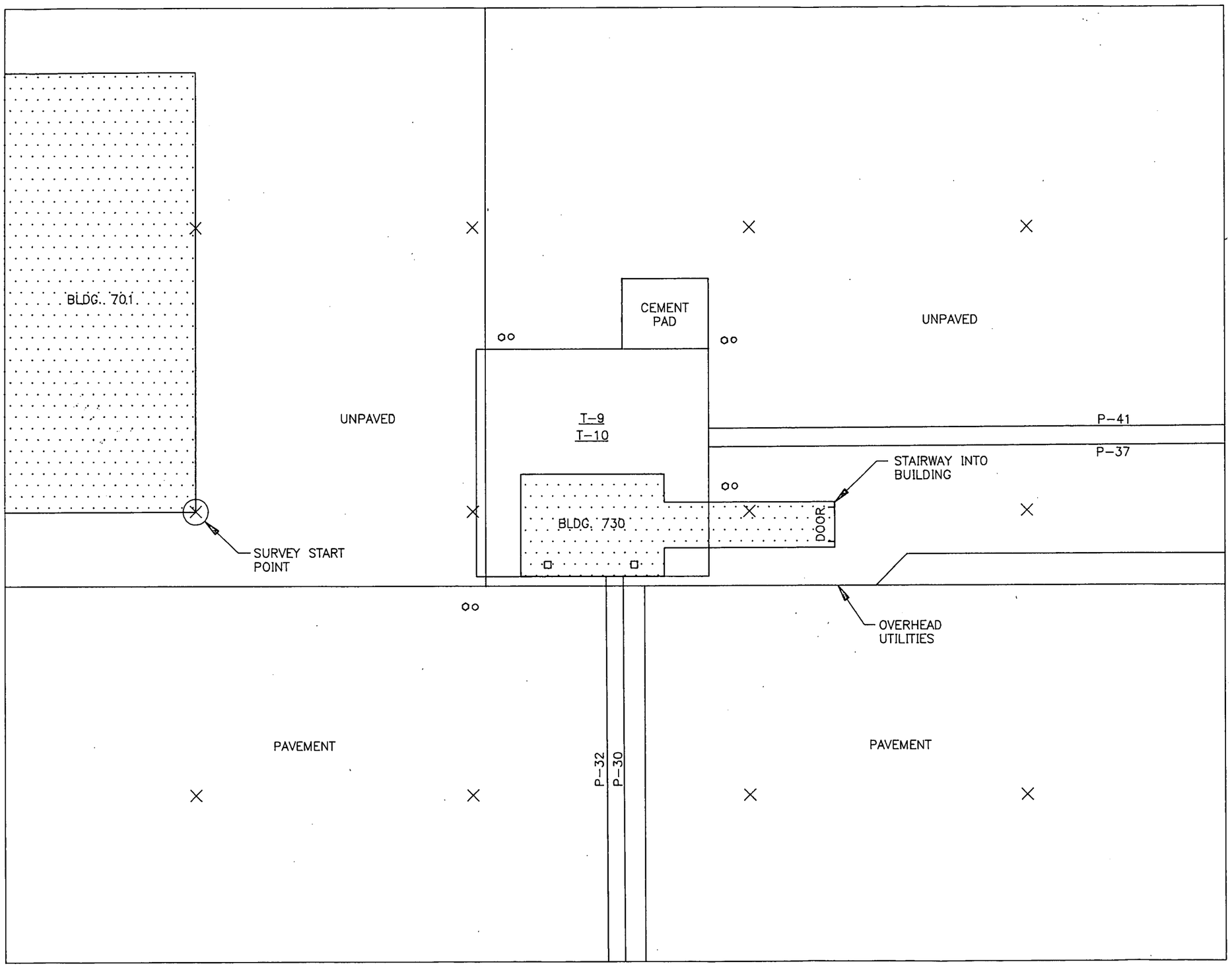
-N-

FIGURE 3-3
SAMPLE LOCATIONS
FOR T-7
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"

C:\RLATS\TC\T-7.DWG



U.S. Department of Energy
Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

ACTIVITY	NUMBER
Borehole	4
Residual	2
Hydropunch	4
HPGe	12

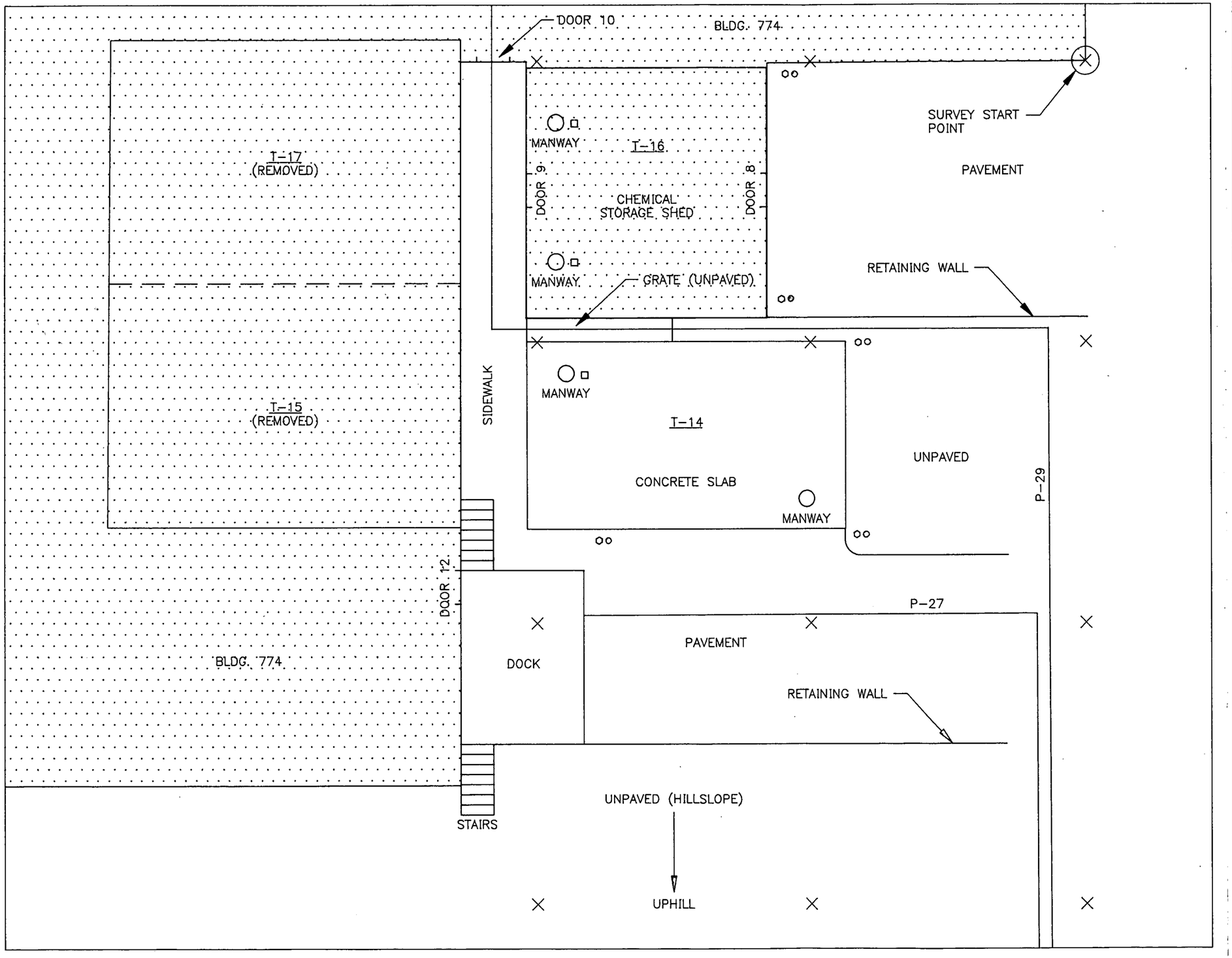
-N-

FIGURE 3-4
SAMPLE LOCATIONS
FOR T-9 AND T-10
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"

C:\RLATS\TC\T-9_10.DWG



C:\RLATS\TC\T-14_15.DWG

U.S. Department of Energy
Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

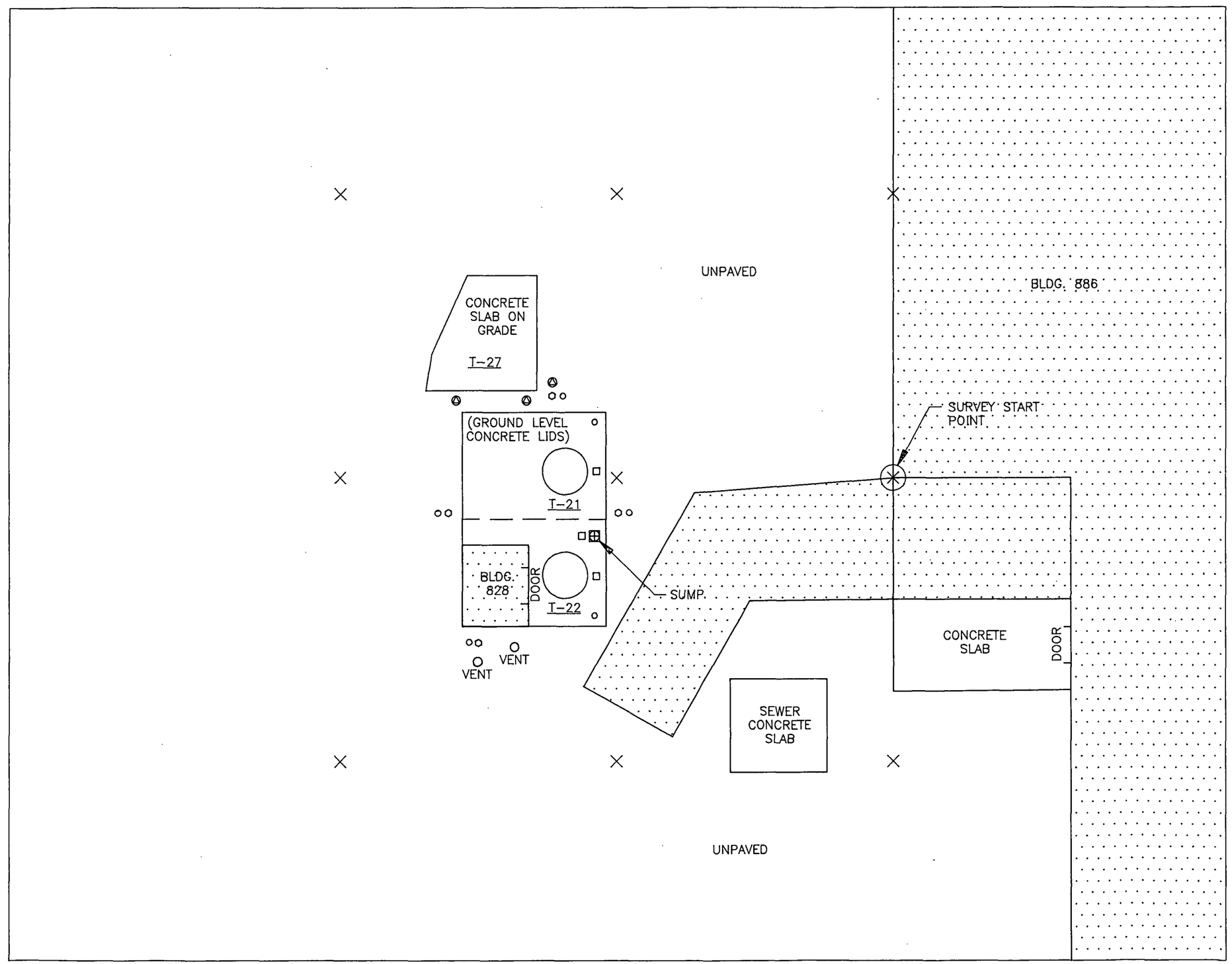
ACTIVITY	NUMBER
Borehole	5
Residual	3
Hydropunch	5
HPGe	12

-N-

FIGURE 3-5
SAMPLE LOCATIONS
FOR T-14, T-15,
T-16 AND T-17
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"



U.S. Department of Energy

Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

ACTIVITY	NUMBER
Borehole	4
Surface Soil	3
Residual	3
Water	2
Hydropunch	4
HPGe	9

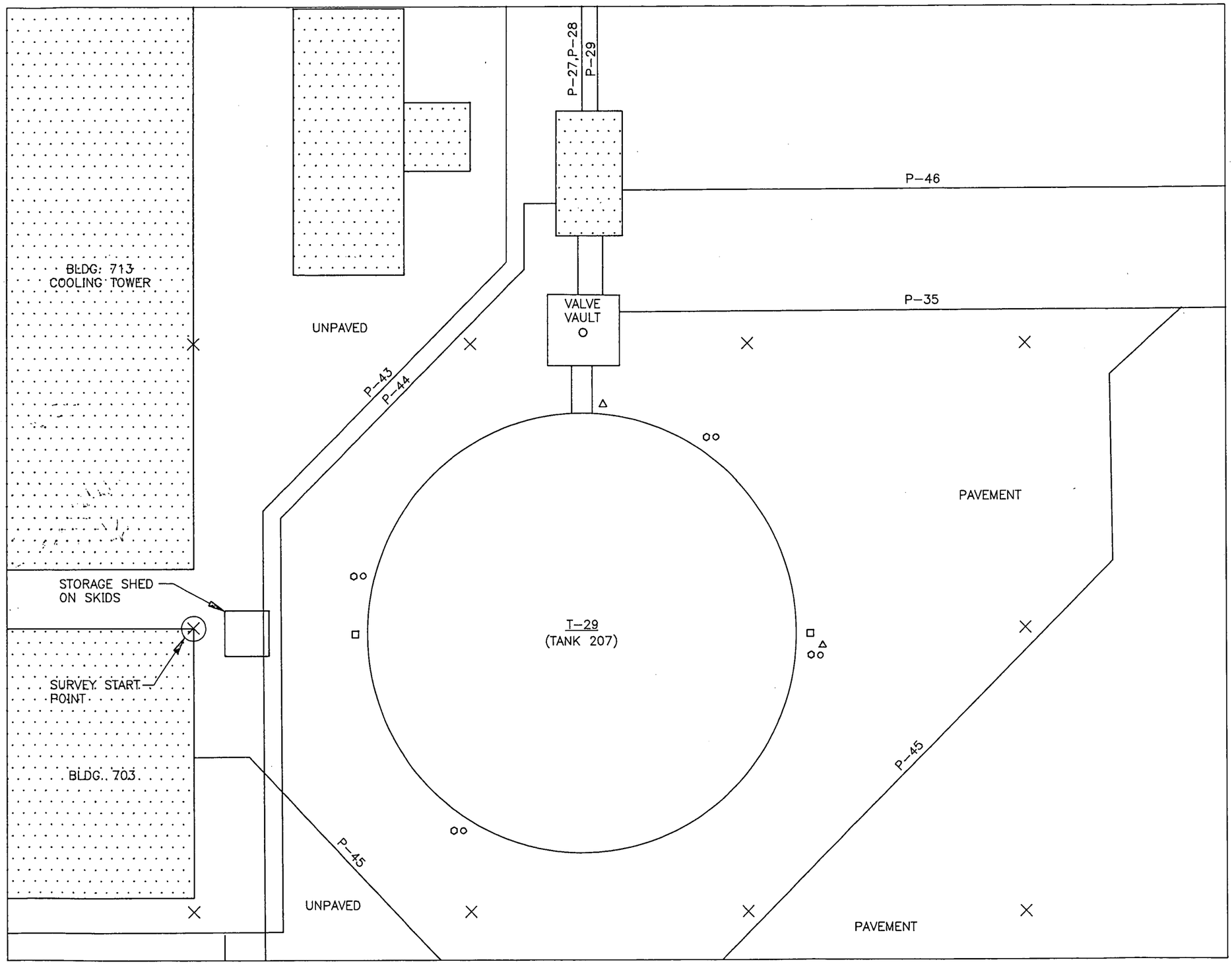
FIGURE 3-6
SAMPLE LOCATIONS
FOR T-21, T-22 & T-27
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"

C:\RFLATS\TC\T-21_22.DWG



U.S. Department of Energy
Rocky Flats Plant

- Buildings
- Tanks
- Overhead Utilities
- Process Waste Lines

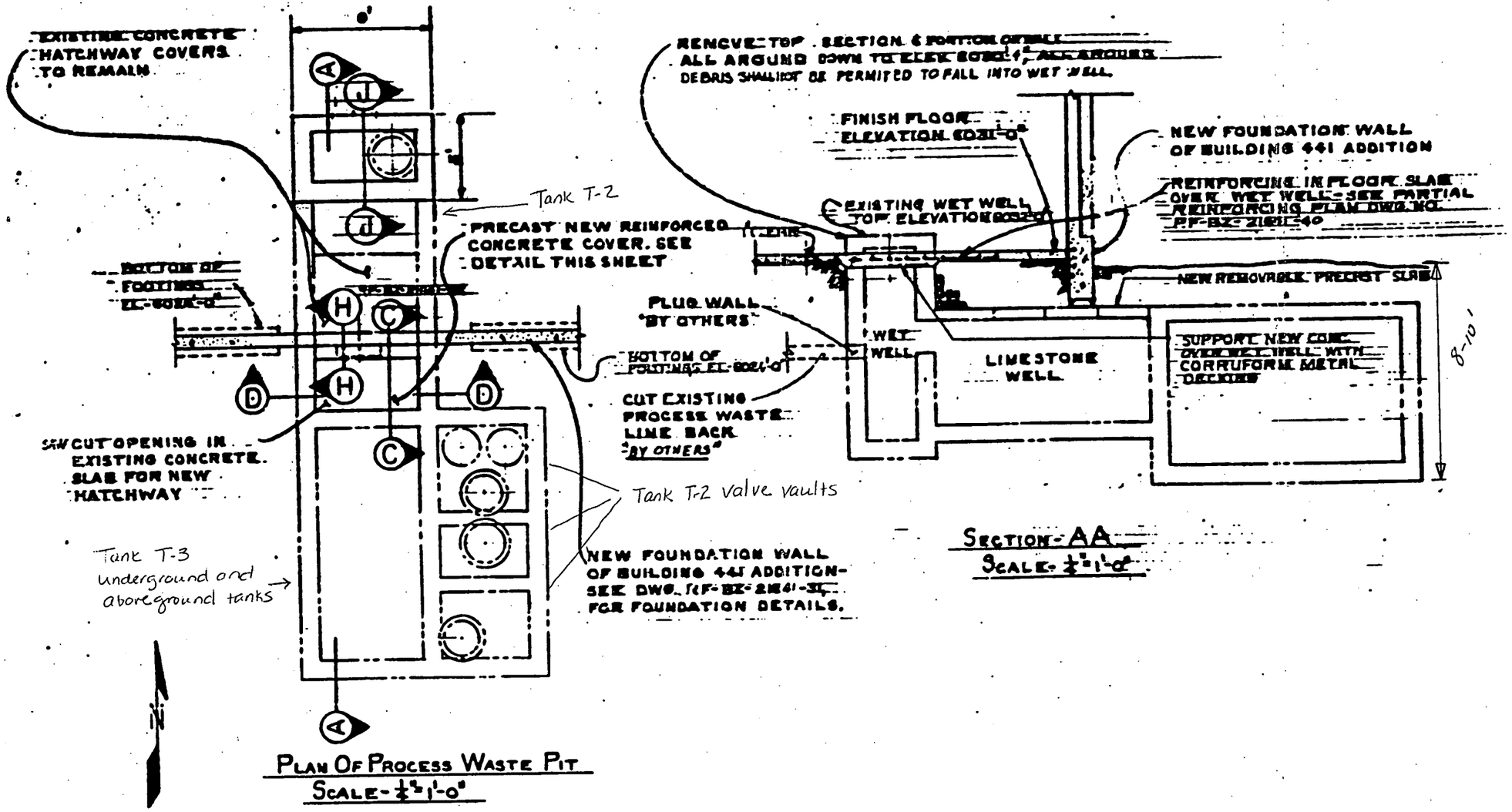
ACTIVITY	NUMBER
Borehole	4
Surface Soil (Grab)	2
Residual	2
Water	1
Hydropunch	4
HPGe	10

-N-

FIGURE 3-7
SAMPLE LOCATIONS
FOR T-29
Operable Unit 9
Original Process Waste Lines

EG&G ROCKY FLATS
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

SCALE: 1"=9'-0"



EG&G ROCKY FLATS TANKS

TANKS T-2 AND T-3

EG&G ROCKY FLATS TANKS

TANKS T-14, T-15, T-16, T-17

T-16

MAN HOLE

66
(Existing)

OVER FLOW PIPE

T-15

33
(Exist.)

Pipe Tunnel

Existing 3"
Existing 4"

T-15

30
(Exist)

T-16

MAN HOLE

67
(Existing)

T-17

31
(Exist.)

T-17

32
(Exist)

OVERFLOW PIPE

Contract will terminate with lines open-ended and exposed

T-14

Refer Detail A

Sump

10" (Typ.)

T-17

34-W
(Exist)

T-17

34-E
(Exist)

Existing 3"
Existing 4"

These existing lines underlie the two 3" lines from the new tank

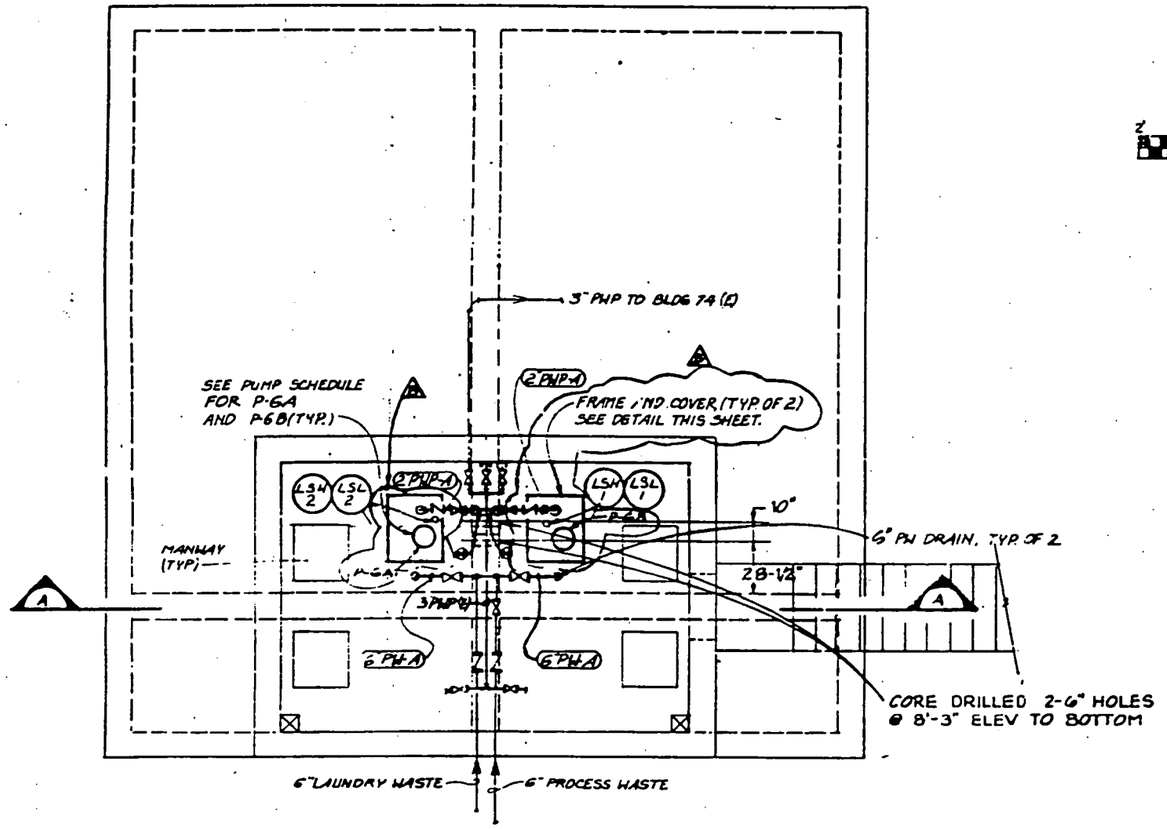
MAN HOLE

Slope

MANHOLE

Refer Detail B

D-4

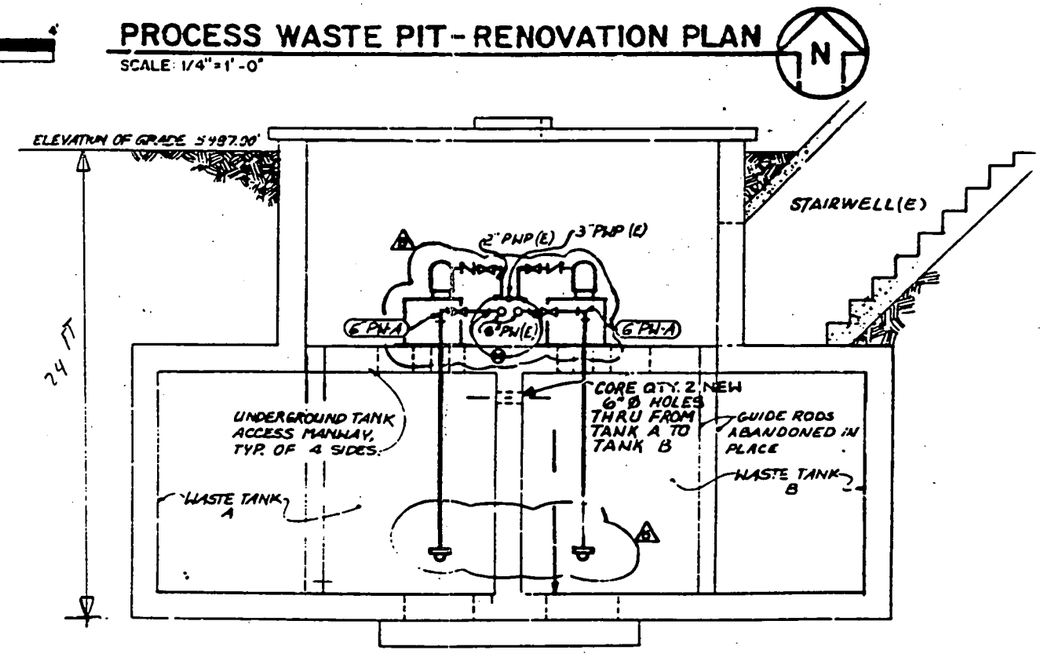


2' 0 4'

PROCESS WASTE PIT - RENOVATION PLAN

SCALE: 1/4" = 1'-0"

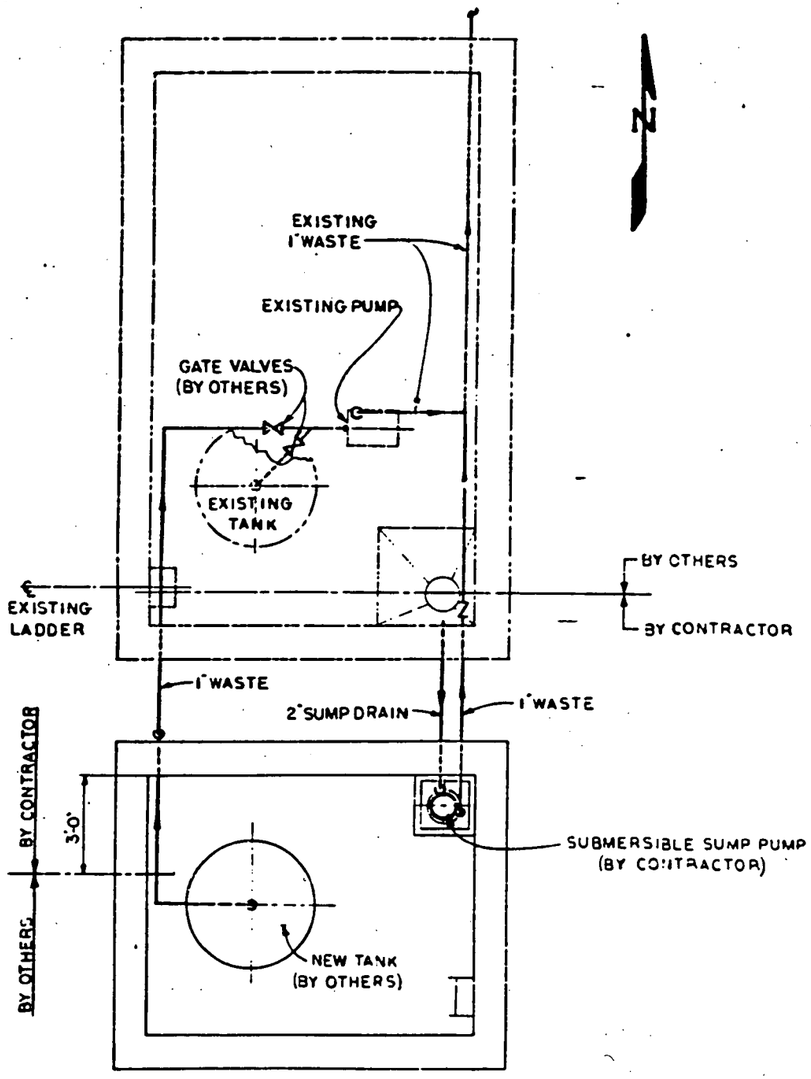
N



SECTION A-A

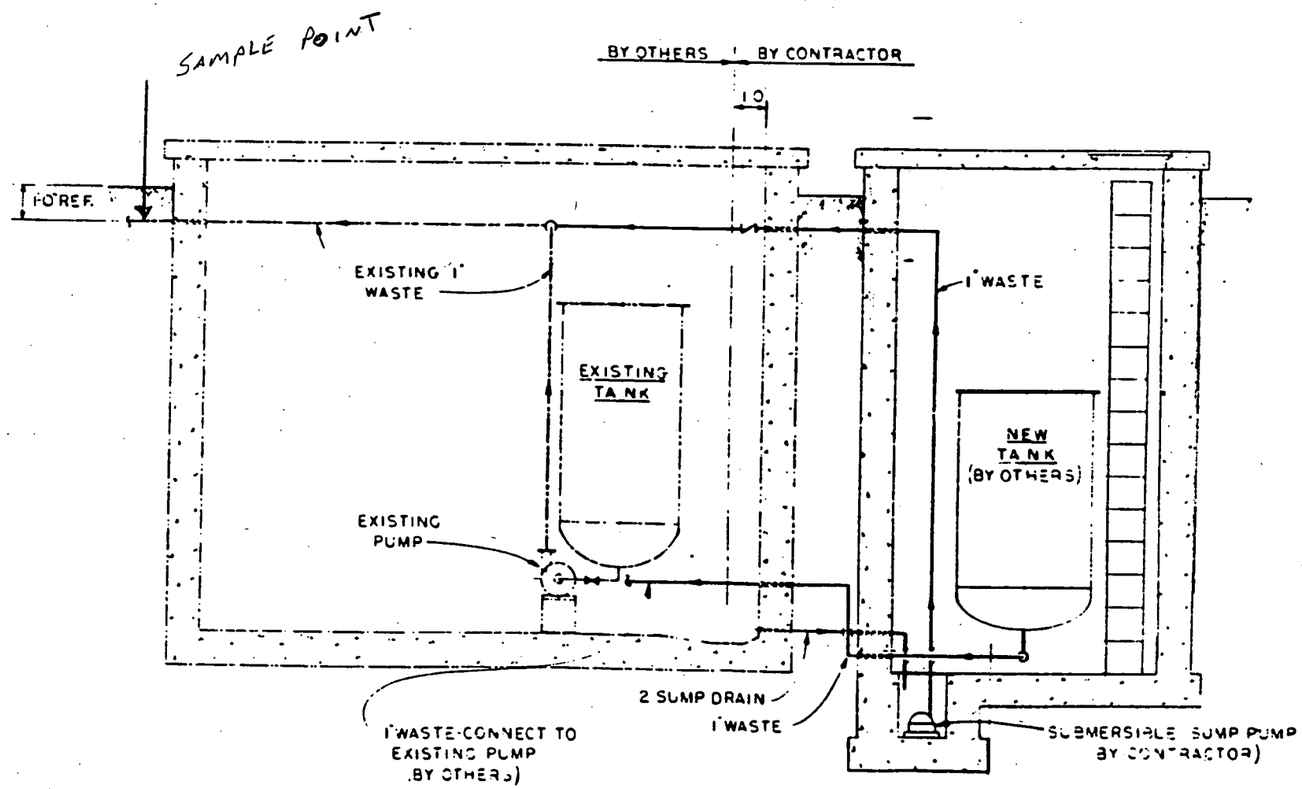
EG&G ROCKY FLATS TANKS

TANKS T-9 AND T-10



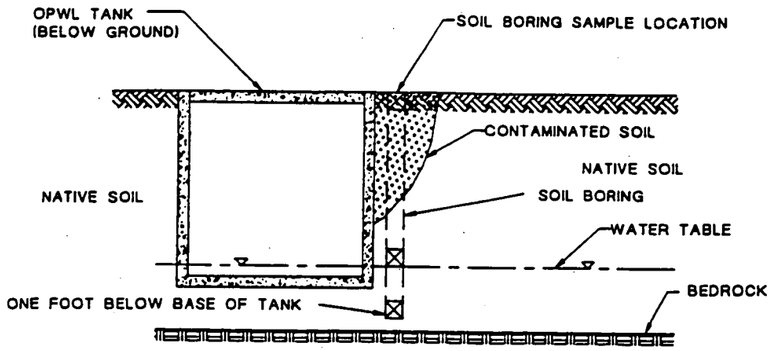
PLAN

SCALE 3/8"=1'-0"

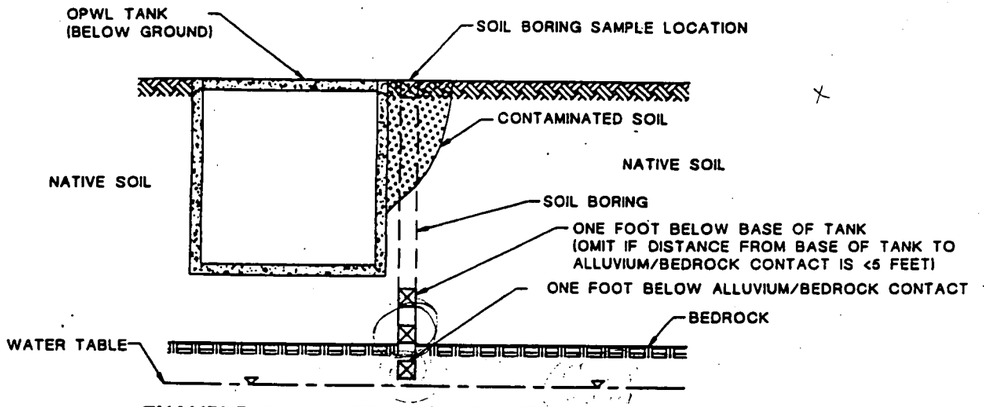


EG&G ROCKY FLATS TANKS

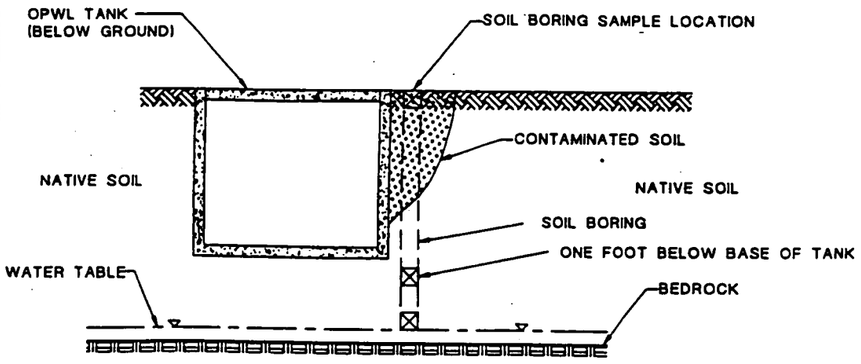
TANKS T-21 AND T-22



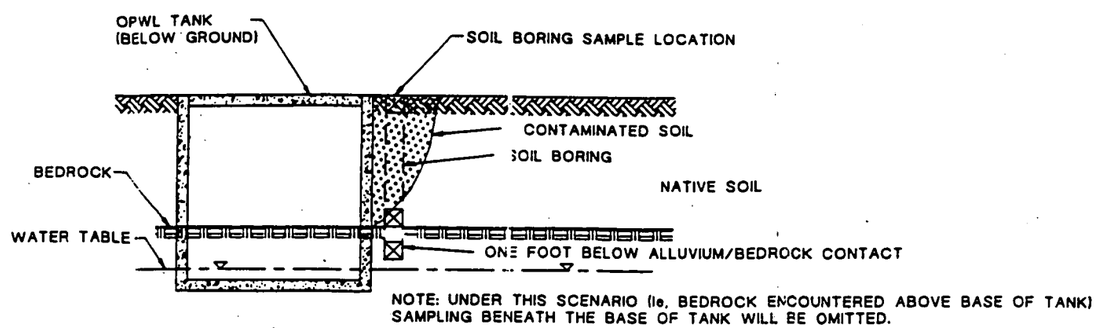
EXAMPLE 1 - WATER TABLE ABOVE BASE OF TANK



EXAMPLE 2 - WATER TABLE WITHIN BEDROCK

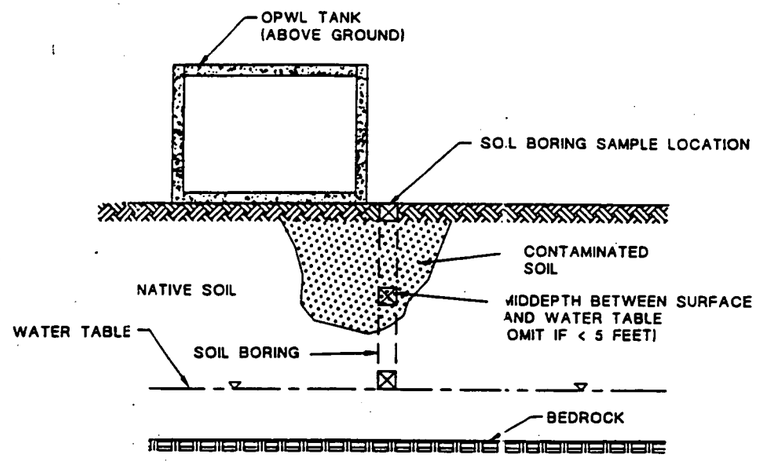


EXAMPLE 3 - WATER TABLE ABOVE BEDROCK, BUT BELOW BASE OF TANK



NOTE: UNDER THIS SCENARIO (ie, BEDROCK ENCOUNTERED ABOVE BASE OF TANK) SAMPLING BENEATH THE BASE OF TANK WILL BE OMITTED.

EXAMPLE 4 - WATER TABLE WITHIN BEDROCK AND TANK "KEYED" INTO BEDROCK



EXAMPLE 5 - WATER TABLE ABOVE BEDROCK AND ABOVE GROUND OPWL TANK

NOT TO SCALE

NOTE: IF TANK HAS BEEN REMOVED THE SOIL BORING WILL BE PLACED APPROXIMATELY IN THE CENTER OF THE ORIGINAL TANK LOCATION.

PREPARED FOR:
U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

FIGURE 7-8

TITLE:
TANK SOIL SAMPLING LOCATIONS

PROJ. NO.	304908	DWG. NO.	4908-B131
DESIGN BY	C. Carney	CHECKED	CJR
DRAWN BY	KRONER	APPROVED	CJR
DATE	2-18-92	SCALE	NOT TO SCALE

4908B131 03/10/92 1:27pm AWK

U.S. Department of Energy
Rocky Flats Plant

ORIGINAL PROCESS WASTE LINES MAP

- *Buildings*
- *Tanks of Immediate Interest*
- *Remaining Tanks*
- *OU 9 IHSS*
- *IOU Overlap*
- *Paved roads*
- *Dirt roads*
- *Original Process Waste Lines*

FIGURE 1-1

Mapscale = 1 : 2400
1 inch = 200 feet

200 0 400 800ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

Prepared by:
EG&G ROCKY FLATS

Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80402-0464

Date: December 21, 1993

OU9-A-000137